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THE CYPRINODONTS.

By S. GARMAN.

WITH TWELVE PLATES.

CAMBRIDGE, U.S.A.:
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THE CYPRINODONTS.

The "Cyprinodonts," "Top minnows," or "Toothed Carps," as they are variously called, form a well defined group. An average of their shapes would approach that of a common Gold Carp with the tail rounded instead of notched. The species resemble the Carps, Cyprinidæ, in form, possession of a single dorsal fin, absence of a pouch on the stomach, lack of pyloric appendages, and in other features; but they are readily distinguished by scales on the head, and the teeth on the jaws, by the forms and dentition of the pharyngeals, the structure of the air bladder, and by their habits. In a general way it may be said of this family they are surface fishes, while the Carps, properly so designated, are fishes of the bottom. All the Cyprinodonts are small; none of them reach the length of a foot, most are less than six inches; and among them are found the smallest of the fishes, in species of which the individuals are fully mature at a length of less than an inch. From carnivorous they range to mud-eating, and from oviparous, laying numerous eggs, to ovoviviparous, producing comparatively few. Like other bony fishes some lay their eggs; others retain the embryo until the yolk is entirely absorbed; in a few of those that keep the embryo until fully developed, it is provided with albuminous nutriment, in addition to the yolk, within the egg, and is possessed of a peculiar temporary absorption system by which it avails itself of the provision. From ordinary sexual habits, such as most prevail among their allies, the Cyprinodonts vary to the extraordinary conditions, described below, in which the males and females are rights and lefts, that is, in which a dextral male pairs with a sinistral female, or a sinistral male with a dextral female. In this case sexes exist in nature that in a measure are

> "Like those sweet birds that fly together,
> With feather always touching feather,
> Linked by a hook and eye,"

of the poet's imagination.*

* Translated by Moore from Abdallah's Persian, referring to the jaftak, "a sort of bird that is said to have but one wing; on the opposite side to which the male has a hook and the female a ring, so that when they fly they are fastened together."

Between the sexes in certain species of these fishes there are great differences in size and shapes; commonly the female is larger and less modified. The greater number belong to the fresh waters; many are inhabitants of brackish water or of the sea along the shores.

In the new world the known distribution extends from the basin of the great lakes and British America on the north to Argentina and Chili on the south, and from the Pacific to the West Indies and the Bermudas; in the old world it comprises the whole of Africa, Madagascar, the Seychelles, and the southern portions of Europe and Asia, from Spain to India and Japan. Marine species are known only near the surface; fresh water species carry the vertical distribution from the sea level up to altitudes of 13,000 feet or more; the highest points reached by any of the fishes.

Brownish or olivaceous, more or less tinted with greenish or yellowish, prevail in the ground colors. Metallic tints, especially those of silver, are common, most on the males. Apparently some of the species, or individuals, pass from the fresh to the salt waters; on these a change in the coloration obtains similar to that affecting Salmo salar, which in the land-locked stage, so called, is more brown with numerous spots of black, but which on reaching the sea becomes more silvery with obsolescent spots. This modification is marked in the common minnows of the Gulf coast, Fundulus grandis, and in F. heteroclitus, from the Gulf northward along the eastern coasts of the United States. Another variation is exemplified by F. heteroclitus, a general diffusion of brownish with corresponding decrease in the amount of silver, or in the brilliancy of coloration; this is noticeable on comparing the more modest coloration of the variety, *badius*, from Grand Menan with the more ornate representatives of the species from South Carolina to Florida. The male is the more highly colored of the sexes. Of some species the males are brilliant with striking combinations of red, orange, yellow, green, blue, gold, silver, white, or black, several of which colors sometimes unite in producing marked contrasts as compared with the plainer garb of the females. The fins of some of the males resemble the wings of gorgeous butterflies, in Mollienisia for instance. Among birds the female is commonly more modest in color than the male; this according to the Darwinian is beneficial, in that it renders the female less conspicuous when nesting; whether the benefit caused the difference is another question. Females of these fishes also are less conspicuous than the males; but necessarily the fact in this case is provocative of some other theory in explanation. Considerable changes in color-

ation, and in the shapes and sizes of their fins are undergone by males in the breeding season, for examples, in Mollienisia and Xiphophorus, the former in its enlarged and ornamented dorsal fin, the latter in its sword-shaped caudal, and both in the acquisition of brilliant colors over the body. By common experience collectors find males to be less numerous than females. The striking appearance of the male will no doubt be claimed as evidence of selection because of a possible benefit in enabling the female more readily to find him; it may also be utilized in explaining the discrepancy in numbers since it must be effectual in making him an object of more prominence and a more frequent prey than the other sex for enemies of the species. From this one might be led to inquire whether the species is not on the way to extinction, or whether the females eventually are somehow to continue its existence on their own responsibility.

Plates IX. to XII. show admirably, so far as black and white may do it, various phases of the coloration in species of several genera. These plates are from the pencil of the artist Sonrel; they were originally intended by Professor L. Agassiz for his work on the North American Fishes, of which the present is to be regarded as a continuation. The differences between the young stages, in which the sexes are alike, and the adult, in which males differ from females, of Fundulus majalis, are indicated on Plate IX. Very young individuals are blotched with black along the side; adult males have vertical bands, while adult females are longitudinally banded, except at the base of the tail. On Plate X. variations within the species Zygonectes Nottii are shown to include all phases between such as exhibit a spot on each scale and those with longitudinal stripes or transverse bands or combinations of both bands and stripes. Plate XI. depicts, among the ordinary variations of form and coloration, a couple of the startling mixtures occasionally met with in Gambusia Holbrookii, Fig. 4 and 5, in which the specimen takes on a dress entirely at variance with that common to the species. The presence of parasites in certain individuals thus peculiarly marked suggests a possible connection of such variation with disease. The Professor has figured both sexes of Mollienisia latipinna on Plate XII., and has indicated the progressive modification of the male. Ornate as shadow and light have made these figures, without considerable more assistance, the imagination will yet fail to supply the tints, of blue, green, orange, silver and gold, necessary to represent the ornamentation of a living individual.

The most common form of body is slightly compressed; it varies to

depressed in Anableps, and to much compressed in Cyprinodon and others. In all species the caudal region is compressed. The head and cheeks are covered with scales. The gills, four in number commonly, are well protected. Those forms subjected to the roughest treatment, from rocks or currents, as Anableps, have the walls of the gill-chamber of more than ordinary firmness. Pseudobranchiæ occur in few cases. The scales are comparatively large and firm; on Rivulus they are thin, and on Orestias, with age they become thick and tubercular on some portions of the body and head.

With the variety in habits there are great differences in structure. Such are particularly noticeable in the mouth. Generally the intermaxillary forms the upper border of the mouth and is dentigerous. Among those forms in which the mouth is most protractile the internarial processes of the intermaxillaries are narrow and elongate; but in species like Cyprinodon these processes are short and broad. Belonesox and Haplochilus have the intermaxillaries produced forward so that the snout is shovel-shaped. Ordinarily the upper jaw is narrow at the angle of the mouth; Nothobranchius has a mouth more like a perch. The mandibles of many are firmly joined at the symphysis; but in Pœcilia and allies the connection is very loose. Exceptional species of Haplochilus have vomerine teeth. On Plates I. to V., the teeth of many of the genera and species are shown. The variations range from the simple conical firmly set teeth of Haplochilinæ to the compressed tricuspids of Cyprinodon, or to the broad oar-shaped movable ones of Pœciliæ. The number of series varies from one to many. Funduloids usually have on each jaw a series of larger teeth behind which there are several series of smaller ones in a viliform band. There are African species which have two series of larger ones to each jaw, and between them a band of smaller ones. The pharyngeal teeth vary nearly as much as those of the mouth. In some they are simple conical hooks; in others they have a shoulder, more or less blade-like, below the hook; and in still others, some or many of the teeth lose the cusps and enlarge to become stout, broad-crowned molars. These teeth are rigidly set in most cases, but in Pœcilia, as Duvernoy has pointed out, they are more less movable. In certain aspects the affinities of the genera are rather more apparent in them than in the teeth of the jaws.

To some extent the teeth are convenient for purposes of classification,

but reliance is not to be placed entirely on them. The same may be said of the anal fin, or other features, when taken alone. By means of the anal the family might readily be subdivided into three groups: a first, in which the anal is not modified on the male, a second, in which it forms a clasper without an urogenital tube, and a third, in which a tube passes to the extremity of the fin; but in the first we should have Haplochilinæ with conical teeth and Cyprinodontinæ with compressed tricuspidate, and in the second Gambusiinæ, with conical, and Pœciliinæ with compressed teeth, while in the third would be placed the conical toothed Anablepinæ with the compressed tricuspidate toothed Jenynsiinæ, both of which are still more widely separated by the eyes and the ventral fins. To depend on the teeth alone would bring together the Cyprinodontinæ, Jenynsiinæ, and some Pœciliinæ, by the compressed and fixed dentition; by the conical shapes, Haplochilinæ, Gambusiinæ, and Anablepinæ would be included; and by the oar-shaped and movable, only a part of the Pœciliinæ would be placed. The unnatural nature of such arrangements is sufficiently evident.

Five or six branchiostegal rays are most common; in a few types the number is smaller.

With the variety in the food, the gill rakers vary in the different genera from short and tubercular to elongate.

The greatest departure from the average vertebra is seen in Anableps where each side of each segment of the column over the body chamber has an elongate triangular process, grooved on the upper side, to the end of which the rib is attached. Great breadth of back with shortness and greater strength of rib is secured in this genus by means of these processes. At the base of the tail behind the terminal vertebra the processes forming the support of the central portion of the caudal are broad and fan-like posteriorly throughout the family; in some instances the hindmost pair anchylose, and form a single broad expanse, in which the original lines of separation are hardly visible. In number the vertebræ vary considerably. Anableps has more than fifty; certain species of Cyprinodon have hardly half as many. A peculiar modification of several of the vertebræ is to be noticed on males of some species, in which the anal fin is modified and carried forward; an inferior process from the centra of two or more of the vertebræ over the hinder portion of the body cavity is sent down to furnish support for the base of the transformed fin, Plate VIII. In Pœcilia there are two of these stays; in Gambusia there are two in one species, and three, with more or

less modification, in others; and in Heterandria, Glaridodon, and Girardinus, there are three. In addition, on the stays, lateral processes are prominent in some; while in others the inferior stay alone is to be discovered. On Xiphophorus there are four or five of the stays. Another feature of the modification occurs in the males of some species, of Glaridodon for example, in which the basal spines, to which the anterior anal rays are articulated, are much broadened. This is most pronounced in forms on which the clasper is longest, and it furnishes a broader base of attachment for the muscles controlling the movements of the organ.

By recent discussion attention has been directed to a decrease in the number of vertebræ, of fishes in general, in and toward the torrid zone, and several theories have been propounded to account for the phenomenon. The species of this family, and others, have been somewhat carefully studied, — first, to determine the facts, and, second, to test the theories. It is found that those species making most use of the vertebra and the column have the greatest number of vertebræ whatever the temperature, as may be seen in the different genera together inhabiting Cuban waters, or those of Brazil, or in the different species of a single genus like Orestias in Lake Titicaca. It is true a decrease obtains, with few exceptions, in the direction of warmer waters, but warmth of water in such instances is attended by both increase in the amount of food and decrease in the need of it, thus lessening the comparative activity of the species. Some would ascribe the differences directly to natural selection. This hypothesis of course cannot be proved; it begs the entire question. It is also found that with the decrease in the number of vertebræ, there is in some cases a decrease in the number of fin rays and scales.

The stomach is an enlargement of the intestine; it is not particularly distinct, and is without a pouch or caecal appendages. As with higher animals, the intestine is shorter in proportion to the greater amount of flesh in the food. Variation in regard to feeding habits in the species of a genus are readily indicated by comparisons of this organ. Fundulus in general has a comparatively short intestine; but in F. Kansae the tract is much elongated. Lebias has a medium length, while its nearest ally, Cyprinodon, has an intestine considerably longer. This organ in the mud-eating species is very long.

A membranous air bladder is present in all the known species of this

family. In females it forms a single large chamber behind and above the ovaries and intestine; in males of those species in which the anal fin is much carried forward, the stays from the vertebræ and the supports of the anal divide the air bladder into separate chambers.

The ovaries vary somewhat according to the modes of reproduction; the simpler forms are the oviparous. Anableps represents the most modified. The embryology of this genus as interpreted by Valenciennes and Wyman is liable to some corrections; these are noted below under the generic description. The development of another of the viviparous forms, Gambusia, has been well worked out by Ryder. The breeding female of some Funduli is provided with a tube upon the anal fin, which, though less developed, recalls that of the female Rhodeus of the Cyprinidae; it varies with the season. An urogenital tube on the anal fin is a marked feature of the male in Anablepinae and Jenynsiinae, Plates VII., VIII. The absence of this tube distinguishes other viviparous forms. In these latter the clasper varies much in length and structure; it may be barbed, or furnished with hooks, or provided with fleshy pads, or may end in a simple point without either barbs, hooks, or flaps.

The kidneys and testes resemble those of most fishes. Their secretions are not thrown together in a common receptacle, as was supposed to be the case by Valenciennes in Anableps. The structure of the separate receptacles is sketched on Plate VII., and described below.

A minor sexual character is that of the small spines appearing on the fins of males in several genera in breeding time; and another is seen in the growths of the fins, anal and dorsal in particular, at the same time.

As in the organs of nutrition, excretion, and generation, there are considerable differences in the sensory apparatus. The peculiar eye of Anableps, half of which looks up and half down, has been well known since the time of Artedi. This genus has a tubular nostril; also possessed, less developed, by one or more of the other genera.

The affinities of the Cyprinodonts to Esocidæ, Cyprinidæ, and others, were pointed out by Professor Agassiz in his Poissons Fossiles. The family was differentiated quite early, as is shown by the Tertiary fossil types, Lebias and others; its derivation is to be traced through extinct forms. A search for direct connecting links with other recent families is not a promising field of inquiry.

HISTORY.

It is only in tracing the origin of a couple of the generic names, Fundulus and Pœcilia, that the history of the Cyprinodonts is carried back farther than the time of Artedi, 1738. Fundulus was originally applied to species of the Cyprinidæ, the habits of which kept them near the bottom and made the name more appropriate than it is in its present use among the "Top minnows," as placed by La Cépède. The earliest mention is that of Albertus Magnus, 1478, lib. 7, tract. 1, cap. 8, who applies Fundula to a fish that is probably Cyprinus gobio of Linné, Gobio fluviatilis of Fleming. Figulus, 1540, and Gesner, 1556, connect the name Fundulus with species of Gobio or Cobitis (Misgurnus). Gesner, 1558, refers both forms, Fundula and Fundulus, to Cobitis barbatula. Schwenckfeld, 1603, gives Fundulus seu Fundula a similar connection, and in this is followed by Aldrovandi, 1613. Schonevelde, 1624, presents the Italian form, Fondola, under Cobitis fluviatilis, and the Latin, Fundulus, under Gobio fluviatilis. Charleton, 1677, has "Gobio fluviatilis, *Fundulus* (quia degit in fundo:) the *Gudgeon*, aut *Pink*." Willughby, 1686, and Rzaczynski, 1721, speak of Fundulus as a name for Cobitis fluviatilis, or an allied fish. Artedi, 1738, places "*Fundulus seu Grundulus* Figul. f 1 b," among the synonyms of Cobitis barbatula, Syn. Pisc., p. 2, and again has Fundulus among those of Gobio fluviatilis, p. 11, and in the Philosophia, p. 65, he notes it as an instance of diverse application of vulgar names. Klein, 1744, Miss., IV., 60, under one of his species of Enchelyopus mentions the name as applied to Gobio fluviatilis. Wulff, 1765, and Müller, 1774, bring the name within the Linnæan period. In all these cases it has been used as a vernacular or common name. La Cépède, 1803, first made it the name of a genus, transposing it from the Cyprinidæ to the Cyprinodonts, from fishes of the bottom to those of the surface.

Pœcilia also has a pre-Linnæan history. As Pœcilias it served Schwenckfeldt, 1603, as a name for a fish, probably Cobitis fossilis (Misgurnus). Rzaczynsky, 1742, makes a similar use of it. Schonevelde, 1624, applies Pœcilia to a form possibly the same. Artedi, 1738, Syn., p. 3, puts at the end of his synonymy for Cobitis cærulescens (Misgurnus fossilis LaC.) "*Pœcilia* Schonev., p. 56, forte?" Referring to Schonevelde, Klein, 1744, Hist. Pisc. Miss. IV., 59, remarks upon the name under a species of his Enchelyopus, possibly Cobitis fossilis of authors. The name is first used as that of a genus, by Bloch, Schneider, 1801, among the Cyprinodonts, and there is nothing on which to base a claim for priority in other or earlier usage.

The direct history of the Cyprinodonts begins with Anableps anableps of Artedi, 1738. In his Synonymia this author mentions the genus, with references to his Genera, and to Seba's work, saying, "Est piscis antea non descriptus; cujus adcuratam delineationem in opere D. Sebae dedimus." In the Genera he gives the generic characters "*Membrana* Branchiostega Ossiculis sex. *Pinna* unica, exigua, in extremo dorso," remarking for the species "Novus piscis, quem in *Sebae* thesauro descripsi." His description, in the third volume of the Thesaurus, occupying four pages folio with figures noting the peculiarities of the eye and anal fin among other features, was not published till 1761, after Anableps had been mentioned by Linné in several editions of the "Systema," and described and figured by Gronow, 1754. Linné's, 1766, Cobitis heteroclita, now Fundulus, was the second species of the family to be recorded. Another species, now of the same genus, was made known by Schoepff, 1788, and received a Latin name, Cobitis majalis, at the hand of Walbaum, 1792. Bloch, Schneider, 1801, added a new genus and the fourth species, Pœcilia vivipara. La Cépède, 1803, established the genus Cyprinodon, with a new species, C. variegatus, also the genera Fundulus and Hydrargyra, the latter of which is now placed as a subgenus in the former. The next genus in sequence was Lebias of Cuvier, 1817, with the species L. calaritana. This was followed by Mollienisia of Lesueur, 1817, who also added a new species, Hydrargyra diaphana. Rüppell, 1828, made known a new species, Lebias dispar, from the Red Sea. Valenciennes, 1828, also contributed a species, his Fundulus brasiliensis, to the number known previous to 1830 and accepted as valid at the present writing. Several of these had already repeatedly been described and named; their history, and that of subsequent additions and changes of names, is sufficiently indicated in the synonymy given below with the various genera and species.

Before establishment as distinct, the family history of the Cyprinodonts is merged with that of the Cyprinidæ, which may be traced to Rafinesque's "Ordine Cyprinidi," of 1810. This group was made to contain a species of Mugil and three species of Cyprinus. In the Analyse, 1815, Rafinesque characterized his 16th family, "Cyprinia. Les Cypriniens," as follows: "Point d'appendices aux nageoires pectorales, tête étroite, point de seconde nageoire dorsale adipeuse; souvent des dents et opercules quelquefois écailleux." This family comprised genera now distributed among seven or eight families. In the second of its sub-families, the Gymnopomia, he placed

Cyprinodon and Hydrargyra of La Cépède, but located Fundulus and Anableps in his 18th family, the Cylindrosomia. Cuvier, 1817, reduced the family, "Les Cyprins," so that it comprised only true Cyprinidæ and Cyprinodonts. Of the latter he recognized four genera, Anableps, Pœcilia, Lebias, and Cyprinodon. Fleming, 1822, used the name Cyprinidæ, with the characters: "Jaws and teeth feeble. The plates of the pharynx thickly set with teeth. Stomach destitute of a pouch, and the intestine without cæca." As subgenera his family contains Cyprinus, "Gobitis," Anableps, "Poceilia," Lebias, and Cyprinodon. Latreille, 1825, names the family "Cyprinides," and enlarges it by a genus not now admitted.

Authors are somewhat divided among themselves on the question whether the distinct history of the family of Cyprinodonts should begin with Agassiz, 1834, or with Bonaparte, 1838. In this they seem to ignore entirely an earlier work, that of Wagner, 1828. The independent existence of the family commonly known as Cyprinodontidæ really began with his work in Isis, XXI., col. 1053, the article on the genus Lebias. His references and the amount of dependence on Valenciennes make it evident that the paper by the latter in Humboldt's "Observationes" was published as early as 1828, if not earlier; the completed volume bears the date 1832. Wagner's words leave no doubt whatever of his intentions, though mistaking in a couple of details, as is shown by the following: "Die Gattung Lebias bildet mit den Gattungen Poecilia, Fundulus, Cyprinodon, und Molienesia Lesueur, wenn sich letztere Gattung durch weitere Untersuchung bestätigen sollte, eine sehr schöne kleine Familie, welche ich die Familie der Cyprinoïden genannt habe, wegen ihrer grossen Verwandtschaft mit den Cyprinus-Arten, wovon sie sich jedoch durch die Zähne in dem Ober- und Unterkiefer, durch die Lage der Rücken- und Schwanzflosse und die Zahl der Strahlen der Kiemenhaut unterscheiden. Einige dieser Familie gebären lebendige Junge, so wenigstens einige Pœcilien. Schwimmblase ist bey einigen vorhanden, bey andern fehlt sie oder ist nicht untersucht. So fand sie Humboldt bey Pœcilia bogotensis, wo sie doppelt ist, die erste Abtheilung ist eyförmig, die zweyte 2–3 mal länger als die erste. Nach Valenciennes Untersuchungen fehlt sie bey Pœcilia unimaculata. Ich fand eine einfache, ansehnliche Schwimmblase, wie ich oben erwähnte, bey Lebias lineato-punctata. Der Magen und Darmcanal der bisher untersuchten Gattungen scheint gleich gebildet und denen der Cyprinus-Arten analog zu seyn." The exceptions to be taken to the foregoing relate only to Pœcilia bogotensis, which is one of the Characinidæ,

and to the air-bladder, which so far as now known is present in all members of the family. Wagner gives a diagnosis as follows:

"Familia, *Cyprinoïdæ*. Corpus oblongum, subcompressum vel teretiusculum squamatum; caput supra depressum, squamis tectum; maxillæ amplæ; apertura oris parva, transversa; dentes in utroque labro et in pharynge. Membrana branchiostega radiis 4 ad 6. Pinna dorsalis unica, anali opposita vel subopposita. Pisces parvuli, fluviatiles, fere omnes Americæ indigeni. *Genera* quinque."

The five genera are those above mentioned. After all synonyms are eliminated, Fundulus brasiliensis Val. is the only new species. The statements quoted are certainly enough for the establishment of the family. The next question concerns the adoption of the name he gave it. The name Cyprinidæ was fixed upon the carps by Fleming when the "Top minnows" were included, it is true; but it belongs to the carps also by virtue of Rafinesque's use of Cyprinidi, in 1810, when these minnows were not included. The word Cyprinoïdæ is incorrectly written; etymologically corrected, it is identical with Cyprinidæ. It seems to have been Wagner's intention to coin a different word. This is shown both in the form he gives the name as he writes it and in the reason given for bestowing it, "wegen ihrer grossen Verwandtschaft mit den Cyprinus-Arten." As he has failed to give a distinct title, it is left for us to adopt the next subsequent applied to the family as such. Cuvier, 1829, employed the name Cyprinoïdes, as also Cyprins, for the Cyprinidæ inclusive of the Cyprinodonts; in this he has not retained the advance made by Wagner. Bonaparte, 1831, accepted the family Cyprinidæ from Fleming and Cuvier, and made three sections in it, — Anableptini, Pœcilini, and Cyprinini. The sections are made in 1838 to rank as subfamilies; a new one, Leuciscini, is added to the Cyprinidæ, while the Pœcilini are removed to form, by name only, the family Pœcilidæ, modified to Pœcilinidæ in 1839, to Pœcilidæ again in 1840, including Anableptini and Pœcilini only. Previous to Bonaparte's use of his name for either family or sub-family, Kirby, in 1837, had used Pœcilidæ for a family of insects. Pœcilioidei of Fitzinger, 1832, was applied to Umbridæ only.

Agassiz, 1834, four years previous to Bonaparte's separation of the family Pœcilidæ by name and six years before a diagnosis of the family was published by him, again separated and named the family of Cyprinodonts as distinct from the Cyprinidæ, remarking, "Après l'exposition de ces caractères [of the Cyprinidæ properly so-called], on pressent déjà que j'exclus

de cette famille tous les genres qui, dans le règne animal de Cuvier, suivent les Loches proprement dites, savoir les *Anableps*, les *Pœcilia*, les *Lebias*, les *Fundulus*, les *Molinesia* et les *Cyprinodon*, pour en faire une petite famille à part, sous le nom de *Cyprinodontes*." To this family he refers again in 1839, in 1844, and in 1854. It was adopted by Müller, 1843 and 1846, Müller and Troschel, 1848, Gill, 1856, Poey, 1858, Kner and Steindachner, 1865, Fitzinger, 1873, and others, under the name first given, and under the form Cyprinodontidæ, its adoption has been pretty near general. Valenciennes, 1846, retained Cuvier's name Cyprinoïdes, without separating the families and was imitated by Poey, 1855, with the orthography Cyprinoidei and Cyprinoidea. Owen, 1846, renders the name Cyprinodontidæ, mentioning "Umber" as the type, and this form of the title has been somewhat generally accepted, but with the exclusion of the Umbridæ. Swainson, 1839, divided the Cyprinidæ and put his Cyprinæ in the Salmonidæ as a subfamily, while he raised the remainder to family rank as the Cobitidæ with three sub-families, Cobitinæ, Anablepidæ, and Pœcilinæ. McClelland, 1839, has in his family Cyprinidæ, what he calls "a small group" containing Pœcilia, Lebias, Aplocheilus, Fundulus, Molinesia, and Cyprinodon. MacLeay, 1842, placed the Pœcilianæ, Cobitinæ, and Platycarinæ in his Apalopterinæ, a division of the Cyprinidæ. Bleeker, 1859, divides his Cyprinodontoidei into Cyprinodontini, Aplocheilini, Orestiasini, and Anablepini. In 1863, the family became Cyprinodontoïdes, the sub-families *Cyprinodontiformes*, with stirps Tellianini, Cyprinodontini, and Belonesocini, and *Aplocheiliformes*, with stirps Orestiasiformes and Anablepiformes. Gill, 1856, adopted the Cyprinodontes; in 1861, his family became the Cyprinodontoidæ, with sub-families Cyprinodontinæ and Hydrargyrinæ; in 1865 he took up Pœciliidæ, as from Bonaparte; in 1872 he grouped together the Esocidæ, Umbridæ, and Cyprinodontidæ under the name Cyprinodontoidea; and in 1894, ignoring the fact that it was preoccupied in insects, he again prefers Pœciliidæ. This last, or his Cyprinodontidæ of 1872, is the equivalent of the Cyprinodontidæ of Günther and later authors. Günther, 1866, subdivides the Cyprinodontidæ into *Cyprinodontidæ carnivoræ*, containing the Cyprinodontina, the Fundulina, Jenynsiina, and the Anablepina, and the *Cyprinodontidæ limnophagæ*, including such genera as are here placed in the Pœciliinæ.

In the present writing the characters and contents of the family and of the genera vary somewhat from those of other authors, as is indicated in the synopsis below. Though the structure of the eye, of the anal fin and of

the ventrals, together with the great differences in skeletal and embryonic features, might demand rank as a family, the Anablepinæ are included.

CYPRINODONTES.

Cyprinoïdæ Wagner, 1828, Isis, XXI, col. 1054.

Cyprinodontes Agassiz, 1834, Mém. Soc. Sci. Nat. Neuch., I, 35, — 1839, Poiss. Foss., V, pt. 2, p. 47, — 1844, l. c., I, pp. xlvii, 170, — 1854, Am. Jour., XVII, 353; Müll., 1843, Wiegm. Arch., IX, (1) 320, — 1846, Abh. Ak. Wiss. Berl., 183; Müll. & Tr., 1848, Schomb. Fauna, 632; Gill, 1856, Smith. Rep., 264; Poey, 1858, Mem., II, 383; Kn. & St., 1865, Abh. Wien Ak., I, ext. p. 24; Kner, 1867, Novara Fische, 344; Fitz., 1873, Sb. Wien Ak., LXVII, (1) 34.

Pœcilini and *Anableptini* (Sections) Bonap., 1831, Saggio, 94, 113, — 1838, Nouv. Ann. Sci. Nat., Bologna, II, 132 (sub fam.), — 1840, Syst. Vert., 53, — Nouv. Ann. Bolog., IV, 195.

Pœciliini and *Anableptini* Bon., 1850, Consp. Syst. Ichth.

Pœcilianæ McClell., 1839, J. As. Res., XIX, (2) 424.

Pœcilinini Bon., 1839, Sel. Tab. Anal., 14.

Pœcilinæ and *Anableps* Swains., 1838, Classif., I, 365, — 1839, l. c., II, 190, 311.

Pœcilidæ Bon., 1838, Nouv. Ann. Bologna, II, 132, — 1840, l. c., IV, 194, — Syst. Vert., 52, — 1841, Tr. Linn. Soc., XVIII, 299, — 1845, Specc. gen., 8 (as Pœcilidæ the name was first applied to a family of Coleoptera by Kirby, in 1837).

Pœcilinidæ Bon., 1839, Sel. Tabl., 14.

Pœcilianæ MacLeay, 1842, Ann. N. H., 204.

Pœciliidæ Bon., 1846, Cat. Meth. Pesci, 25, — 1850, Consp. Ichth.; Gill, 1865, Can. Nat., — 1894, Mem., Am. Nat. Ac., VI, 133, — P. U. S. Mus., XVII, 115.

Pœcilidi Bonap., 1841, Fauna Ital., Pesci; Doderl., 1879, Atti Ac. Sci. Pal., (2) VI, 56.

Cyprinodontidæ Owen, 1846, Lect. Comp. Anat., 48 (type named belongs to Umbridæ); Grd., 1859, Mex. Bd., II, Fishes, 66, — P. R. R. Rep., X, 302; Rich., 1856, Encycl. Brit., XII. — 1860, Mus. Nat. Hist., Fish, 153; Gth., 1866, Cat., VI, 299, — 1880, Intr., 613; Stor., 1867, Mass. Fish, 127; Gill, 1872, Arr. Fam., 15; Day, 1878, Fish. Ind., 521; Steind., 1880, Denk. Ak. Wien, XLII, 85; Jor. & G., 1882, B. 16 U. S. Mus., 326; Seeley, 1886, Fish. Eur., 22, 369.

Cyprinodontidi Poey, 1868, Repert., II, 209, 410, — 1876, An. Soc. Esp., V, 140.

Cyprinodontoidei Blk., 1859, Enum., 155, — 1860, Zesde Bijd., 59, 99, — Cypr., 479, — 1862, Mém. Poiss. Guin., 116, — 1875, Poiss. Madag., 101, 1879, Enum., 24.

Cyprinodontini Blk., 1860, Cypr., 481, — 1863, Atl., III, 139.

Cyprinodontoidæ Gill, 1861, Cat., 51.

Cyprinodontinæ Gill, 1861, Cat., 51.

Cyprinodontoides Blk., 1863, Atl., III, 139.

Cyprinodontiformes Blk., 1863, l. c.

Cyprinodontidæ carnivoræ Gth., 1866, Cat., 301, — 1880, Intr., 614.

Cyprinodontidæ limnophagæ Gth., 1666, Cat., VI, 339, — 1880, Intr., 617.

In the following references, besides Cyprinodonts other fishes were included.

Cyprinia Raf., 1815, Analyse, 88.

Cyprins Cuv., 1817, R. An., II, pp. viii, 190.

Cyprinidæ Flem., 1822, Phil. Zool., II, 386; Bonap., 1831, Saggio, 113, — 1839, Selach. Tab. Anal., 14; McClell., 1839, Cypr., 424; MacLeay, 1842, Ann. Mag., IX, 203.

Cyprinides Latr., 1825, Fam. R. An., 122.

Cyprinoïdes Cuv., 1829, R. An., II, pp. xii, 269; Val., 1846, C.V. Poiss., XVIII.

Cobitidæ Swains., 1839, Classif., II, 309.

Cyprinoidei Poey, 1855, Mem., I, 390.

Cyprinodontoidea Gill, 1872, Arr. Fam., 15.

Commonly among the fishes of this group the head is somewhat broad and flat on the crown, the body is compressed and moderately arched on the

back, and the body cavity is rather short and deep. The head and body are covered with scales. The mouth is anterior, its upper margin is formed by the intermaxillaries, and its cleft varies from vertical to horizontal in the different genera. The eyes are lateral. Teeth are borne on mandibles and intermaxillaries, in one to many series, and in cardiform groups on the upper and lower pharyngeals. A single dorsal, on the hinder portion of the body. Air bladder simple in the females, membranous, without ossicula. Alimentary tract short to long. No blind sac on the stomach. No pyloric appendages. No adipose fin. No barbels. But few species possess pseudobranchiæ or vomerine teeth.

The descriptions of a number of species lack the details of most importance in comparisons; in consequence it is not possible to satisfactorily place such forms in synopses.

		Page
Teeth compressed;		
anal not modified on the male;		
jaws firmly joined; teeth fixed;	CYPRINODONTINÆ	19
cusps three;		
series of teeth on each jaw one;		
body deep; intestine long	*Cyprinodon*	19
body elongate; intestine medium	*Lebias*	29
ventrals absent;	*Tellia*	35
cusps two; body elongate;		
series of teeth several	*Characodon*	35
intestine short; D. and A. long	*Girardinichthys*	38
series of teeth two	*Neolebias*	39
anal modified, without a tube; teeth chisel or oar-shaped, hooked	PŒCILIINÆ	40
anal process long;		
teeth chisel shaped, broad;		
jaws firmly joined, teeth fixed	*Glaridodon*	40
jaws loosely joined		
teeth movable	*Girardinus*	45
anal process short		
jaws loosely joined; teeth movable		
series of teeth on each jaw one	*Platypœcilus*	48
series of teeth several		
D. long; body short	*Mollienisia*	49
D. short; body short	*Pœcilia*	52
caudal of male sword-shaped	*Xiphophorus*	67
anal modified, with a tube;		
pupil entire; pelvis entire	JENYNSIINÆ	69
males rights and lefts	*Jenynsia*	69
Teeth conical, in bands;		
anal modified, with a tube;		
pupil divided; pelvis divided	ANABLEPINÆ	70
males and females rights and lefts	*Anableps*	70

		Page
Teeth conical, in bands;		
anal modified, without a tube;		
pupil entire; pelvis entire	Gambusiinæ	80
intermaxillaries produced	*Belonesox*	80
intermaxillaries not produced;		
A. smaller than D. and farther back	*Pseudoxiphophorus*	80
A. and D. small; D. backward of A.;		
mouth wide; chin low	*Gambusia*	82
mouth narrow; chin steep	*Heterandria*	90
Teeth conical; pupil entire; pelvis entire;		
anal not modified	Haplochilinæ	93
ventrals absent;		
pharyngeal teeth slender	*Orestias*	145
pharyngeal teeth thick, molars	*Empetrichthys*	116
ventrals present;		
jaws with teeth in a single series	*Lucania*	93
jaws with teeth in bands;		
pseudobranchiæ absent;		
intermaxillaries produced	*Haplochilus*	124
intermaxillaries not produced;		
D. and A. nearly equal;		
origin of D. forward of A.	*Fundulus*	95
first spine of D. strong	*Adinia*	94
caudal forked	*Fundulichthys*	115
origin of D. backward of A.	*Zygonectes*	116
D. smaller than A. and farther back	*Rivulus*	134
body and head compressed	*Cynolebias*	143
body sharp-edged behind vent	*Pterolebias*	141
pseudobranchiæ present;		
mouth resembling that of Fundulus	*Haplochilichthys*	156
mouth resembling that of perch	*Nothobranchius*	158

CYPRINODONTINÆ.

CYPRINODON.

Plate I. Fig. 1–4, teeth.

Cyprinodon La C.; 1803, Poiss., V, pp. xxxi, 486; Raf., 1815, Anal., 88; Cuv., 1817, R. An., II, 199, — 1829, R. An., II, 281, — 1836, R. An., I, 533; Flem., 1822, Phil. Zool., II, 386; Val., 1828, Humb. Obs., II, 164, — 1846, C. V. Poiss., XVIII, 145; Wagner, 1828, Isis, XXI, col. 1056; Schinz, 1836, Abb. Fische, 217; Guer., 1838, Icon., Poiss., 29; Stor., 1846, Syn., 183, — Mem. Am. Ac., 435; Dum., 1856, Ichth., 410; Blkr., 1860, Cypr., 481, — 1863, Atl. Cypr., III, 139; Gill, 1861, Cat., 51; Gthr., 1866, Cat., 301, — 1880, Intr., 614; Jor. & G., 1882, B. 16 U. S. Mus., 328.

Lebia Les., 1821, J. Phil. Ac., II; Swains., 1838, Classif., I, 366, — 1839, II, 190, 311.

Lebias Schinz, 1836, Abb., 216; Guer., 1838, Icon. Poiss., 28; DeK., 1842, N. Y. Fish, 215; Stor., 1846, Syn., 179, — Mem. Am. Ac., II, 431.

Pœcilia (part) Goldf., 1820, Handb., II, 17; McClell., 1839, As. Res., XIX (2), 424.

Trifurcius Poey, 1861, Mem., II, 305, 383 — 1868, Rep., II, 209, 411, — Mem., II, 305, 383.

Jordanella Goode, 1880, P. U. S. Mus., II, 117; Jor. & G., 1882, B. 16 U. S. Mus., 327.

Form robust, short and deep; body and head compressed; back arched; crown flattened; snout short, blunt; caudal pedicel deep. Mouth of moderate size, obliquely directed upward; lower jaws longer, firmly united; upper short, protractile. Teeth in a single series in each jaw, compressed and broadened toward the crowns, tricuspid. Gill membranes united, free from the isthmus. Branchiostegal rays six to five. Origin of the dorsal fin in the anterior half of the length, forward of that of the anal. First ray of dorsal large and strong. Anal unmodified in the male. Ventrals small. Caudal large, deep. Intestine long, much convolute. Species small, hardly as much as two inches in length.

United States to Brazil; Cuba.

Cyprinodon variegatus.

Plate I. Fig. 1 & 2, teeth.

Cyprinodon variegatus LaC., 1803, Poiss., V, 486, pl. 15, f. 3; Flem., 1822, Phil. Zool., II, 386; Cuv., 1829, R. An., II, 281, — 1836, R. An., I, 533; Val., 1828, Humb. Obs., II, 165, — 1846, C. V. Poiss., XVIII, 173; Wagn., 1828, Isis, XXI, 1057; Stor., 1846, Syn., 183, — Mem. Am. Ac., 435, — 1867, Fish. Mass., 279; Blk., 1860, Cypr., 484, — 1863, Atl., III, 139; Gill, 1861, N. A. Fish, 51, — 1873, N. A. Fish, 31; Gth., 1866, Cat., VI, 305; Bd., 1873, R. U. S. F. Com., I, 826; Jor. & C., 1877, B. Buf. Soc., III, 141; Yarr., 1877, P. Phil. Ac., 214; Jor., 1878, B. U. S., G. Sur., IV, 411, 432, — 1885, P. U. S. Mus., VII, 322, — 1887, P. U. S. Mus., IX, 26, — R. U. S. F. Com., 835; Jor. & G., 1879, P. U. S. Mus., I, 384, — 1882, B. 16 U. S. Mus., 329, — 1883, P. U. S. Mus., V, 250, — 1887, P. U. S. Mus., IX, 26; Goode, 1880, P. U. S. Mus., II, 117; G & B., 1880, P. U. S. Mus., II, 151, — 1883, P. U. S. Mus., V, 239; Bean, 1881, P. U. S. Mus., III, 104, — 1889, B. U. S. F. Com., 132, 148, — 1892, P. U. S. Mus., XIV, 92; Jor. & E., 1888, P. U. S. Mus., X, 269; Hensh., 1891, B. U. S. F. Com., IX, 374; Smith, 1892, B. U. S. F. Com., X, 64, pl. 18, f. 1, 2

Le Cyprinodon varié Cuv., 1817, R. An., II, 199.

Esox ovinus Mitch., 1815, Tr. L. & P. Soc. N. Y., I, 441, pl. 4, f. 7.

Pœcilia (*Cyprinodon*) *variegatus* Goldf., 1820, Handb., II, 17.

Lebias rhomboidalis Val., 1828, Humb. Obs., II, 160, pl. 51, f. 3 & 7; Wagn., 1828, Isis., XXI, 1055; Guer., 1838, Icon., Poiss., 28.

Cyprinodon ovinus Val., 1828, Humb. Obs., II, 164; Wagn., 1828, Isis, XXI, 1056; Rich., 1837, Sixth R. Br. Assoc., 213; Bd. 1855, Ninth R. S. Inst., Extr. p. 31.

Lebias ovinus DeK., 1840, N. Y. G. Sur., 29, — 1842, Fish N. Y., 215, pl. 27, f. 84.

Lebia ellipsoidea Les., 1821, J. Phil. Ac., II, p. 5, pl. 2, f. 1–3; Rich., 1837, Sixth R. Br. Assoc., 213.

Lebias ellipsoides DeK., 1842, Fish N. Y., 216; Ayres, 1843, J. B. N. H. Soc., IV, 265; Stor., 1846, Syn., 179, — Mem. Am. Ac., II, 431.

Var. **gibbosus.**

Cyprinodon gibbosus B. & G., 1854, P. Phil. Ac., VI, 1853, p. 390; Grd., 1859, Mex. Bd. Sur., Fish, 67, pl. 38, f. 1–7; Blk., 1860, Cypr., 484; Jor & C., 1877, B. Buf. Soc., III, 141; Jor., 1878, B. U. S. G. Sur., IV, 432; Jor. & G., B. 16 U. S. Mus., 329; G. & B., 1883, P. U. S. Mus., V, 239

Cyprinodon Riverendi Jor., 1885, P. U. S. Mus., VII, 109, 147.

Cyprinodon variegatus gibbosus Jor., 1887, R. U. S. F. Com., 835.

Cyprinodon variegatus Everm., 1893, B. U. S. F. Com., 1891, p. 84; Everm. & K., 1894, B. U. S. F. Com., 1892, pp. 66, 75, 79, 83, 87, 89, 92, 106, pl. 22, f. 2, 3.

Var. **Riverendi.**

Trifarcius Riverendi Poey, 1861, Mem., II, 306, 383, — 1868, Repert., II, 411, — 1876, An. Soc. Esp., V, 140.

Trifarcius Felicianus Poey, 1868, Repert., II, 412, — 1876, An. Soc. Esp., V, 140.

Cyprinodon riverendi Jor., 1887, R. U. S. F. Com., 835.
Cyprinodon variegatus riverendi Jor., 1887, P. U. S. Mus., IX, 564.
Cyprinodon felicianus Jor., 1887, P. U. S. Mus., IX, 564.
Var. **bovinus.**
Cyprinodon bovinus B. & G., 1854, P. Phil. Ac., 1853, p. 389; Grd., 1859, Mex. Bd. Fish, 67, pl. 37, f. 12–18; Blk., 1860, Cypr., 484; Gth., 1866, Cat., VI, 307; Jor. & C., 1877, B. Buf. Soc., III, 141; Jor., 1878, B. U. S. G. Sur., IV, 432, — 1887, R. U. S. F. Com., 835; Jor. & G., 1882, B. 16 U. S. Mus., 890; G. & B., 1883, P. U. S. Mus., V, 239.

B. 6 (frequently 5); D. 11–12 (10–13); A. 11–10 (10–12); V. 7; P. 16–15; Ll. 27–29; Ltr. 12; Vert. 12+12 to 13.

Body and head compressed, deep. Depth of large specimens one half to two fifths of the length to the base of the caudal; back strongly arched from snout to end of caudal, highest in front of dorsal. Head short, as deep as long, two thirds as wide as long, one third of the length to the caudal base; crown flattened. Snout short, blunt, as long as eye, nearly one fourth of head. Mouth medium, oblique, slightly directed upward; lower jaws longer, firmly united; upper short, protractile; chin steep. Eye large, as long as snout, three tenths to one fourth of head, two thirds of forehead. Teeth in a single row on each jaw, chisel-shaped, tricuspid. In young stages the cusps are sharp; with age they are ground down or truncated. Dorsal large, originating nearly midway from snout to base of caudal, anterior ray strong. Anal much smaller than the dorsal and originating below its hinder half, base and tip reaching a little farther backward than on that fin. Ventrals small, hardly reaching the anal. Pectorals larger, reaching behind a vertical from the bases of the ventrals or from the origin of the dorsal. Caudal deep as long, shorter than the head, truncate. Scales large, wide, short; humeral scale larger. Some individuals have five branchiostegal rays on one side; rarely five are found on each side. Pharyngeal teeth compressed, with a blade-like shoulder, above which there is usually a hook. Intestine three to three and a half times as long as the fish. The young are more elongate and less compressed than the old.

Grayish or silvery in ground color, with transverse blotches of brownish on the back and others more or less confluent with them and one another on the flanks. Vertical bars of brown on the flanks more or less y-shaped, wedge-shaped, broken or irregular; varying from narrow and numerous to wide and few. Commonly there are six to eight of the vertical bars, about as wide as the interspaces and alternating with the dorsal blotches. A vertical bar of darker color crosses the bases of the caudal rays, and frequently the caudal is tipped with dark. A large white edged black

spot on the posterior rays of the dorsal, sometimes absent. Rarely a similar spot occurs on the anal. Numerous specimens have dorsal and anal, and more rarely ventrals and pectorals, with dark tips. Top of head dark, clouded. Belly and lower half of head silvery. Aged specimens show a tendency to become uniform olivaceous. New England to Florida.

Var. *gibbosus* has the same markings, with less of the olive, perhaps, but is more brilliant in general coloration, and has a scale or two less in the lateral line. Florida to Texas.

Var. *Riverendi* is much the same in squamation, but has fewer and broader bars and interspaces, and becomes uniform olivaceous with age. Cuba.

Var. *bovinus* differs from *gibbosus* mainly in coloration. It has a narrow silvery band nearly level with the upper edge of the eye to a point a little above the middle of the base of the caudal, separating the dorsal blotches from those of the middle of the flank. The blotches on the side are somewhat confluent in a longitudinal band, with irregular lower margin and more or less broken. The vertical bar on the bases of the caudal rays is distinct, and on many specimens the caudal is tipped with black.

Leon's and Comanche Springs, Texas.

Cyprinodon latifasciatus.

Cyprinodon latifasciatus Garman, 1881, B. Mus. Comp. Zool., VII, 92; Jor. & G., 1882, B. 16 U. S. Mus., 329; Jor., 1887, R. U. S. F. Com. 835; Everm. & K., 1894, B. U. S. F. Com., 1892, pp. 78, 83, 87, 89, 90, 92, 106.

B. 5; D. 12–11; A. 12–10; V. 6–5; P. 15; Ll. 27–30; Ltr. 11; Vert. 13+14.

The shape of this species is similar to that of *C. variegatus*; but marked differences appear in the coloration, the number of branchiostegal rays, and in the number of rays in the ventral fins. In a specimen of two and one eighth inches the depth of the body is contained in the length to the base of the caudal two and one-third times, while the head is about two thirds of the depth. Snout broad, short, blunt; chin steep. Mouth medium, oblique, directed upward; lower jaws longer, upper short, protractile. Teeth in a single series, tricuspid. Eye little less than snout, nearly one fourth of head, or half of forehead. Branchiostegal rays five. Dorsal origin nearly midway from snout to base of caudal, fin rounded on outer margin. Anal large, smaller than dorsal, rounded on outer border; base and tip extending

little farther back than in dorsal; origin below hinder half of dorsal base. Ventrals small, more often with six rays, sometimes with five. Pectorals moderate, reaching behind a line uniting bases of ventrals and origin of dorsal. Scales large, harsh with striæ. On some individuals the edges of the scales about the head are beset with short spines. Similar spines are seen along the anterior rays of the anal fin. Caudal deeper than long, two thirds as long as head, truncate. Intestine long, more than twice the total length of the specimen.

Viewed from above the appearance is black. On the flank there is a brown band from the eye to the middle of the base of the tail; above this there is a narrower more or less indistinct band of silvery; below it there is a wider band of yellowish, and below the latter from the pectorals to the lower edge of the caudal there is a fainter band of brownish. Cheeks brown. Lower surfaces silvery to yellowish. Dorsal brown; pectorals, anal, and ventrals brownish. On lighter colored fins there is a narrow margin of black, in cases preceded by yellowish. Across the bases of the caudal rays there is a narrow vertical bar of brown. Between this bar and a broad margin of black the fin is yellowish to brownish yellow, more intense at the edge of the black border. The black tip of the fin is much broader than in the other species, varying from one third to one half of the free portion.

The variations in shape from small to large individuals are the same as in *C. variegatus*. In colors the variation is greater, being much lighter and more silvery in the young; the pattern in the numerous specimens examined varies but little, which may be accounted for by the fact that all were secured at one locality.

Parras, Mexico.

Cyprinodon elegans.

Cyprinodon elegans B. & G., 1854, P. Phil. Ac., 1853, p. 389; Grd., 1859, Mex. Bd. Sur., Fish, 66, pl. 37, fig. 1–7; Blk., 1860, Cypr., 484; Trosch., 1865, Verz. Wirb. Mex., 104; Jor. & C., 1877, B. Buf. Soc., III, 141; Jor., 1878, B. U. S. G. Sur., IV, 432, —1887, R. U. S. F. Com., 835; Jor. & G., 1882, B. 16 U. S. Mus., 329; G. & B., 1883, P. U. S. Mus., V, 239; Everm. & K., 1894, B. U. S. F. Com., 1892, pp. 66, 75, 83, 87, 92, 106; Woolm., 1894, B. U. S. F. Com., 59.

Cyprinodon eximius Grd., 1859, P. Phil. Ac., 158; Blk., 1860, Cypr. 484; Jor. & G., 1882, B. 16 U. S. Mus., 890; Jor., 1887, R. U. S. F. Com., 835; Woolm., 1894, B. U. S. F. Com., 59.

B. 6; D. 12–11; A. 11–10; V. 6–7; P. 15–16; Ll. 27–30; Ltr. 12.

Outlines similar to those of *C. gibbosus*, possibly a trifle more elongate. Body compressed, depth two fifths and head one third of the length from snout to caudal base. Crown arched. Snout short, blunt, longer than eye; chin steep. Eye shorter than snout, two sevenths of head, three fourths of

forehead. Mouth medium, oblique, opening upward. Teeth in a single series, tricuspid. Branchiostegal rays six. Origin of dorsal midway from front edge of orbit to base of caudal. Base of anal below hinder half of that of dorsal, and extending a little farther backward. Anal fin rounded, hardly half as large as dorsal, but extending farther back. Ventrals small, with six or seven rays, or absent. Some have six rays on one side, seven on the other, and in one case there is no trace of the fin. Pectorals broad, rounded, hardly reaching a line from first ray of dorsal to base of ventral. Caudal large, longer than deep at the base, about two thirds as long as head, slightly concave on the hind margin.

Back greyish brown to brownish; sides lighter, to silvery on the entire ventral surface. Sides with or without a median series of small blotches separated from the brown of the back and from one another by silvery. In cases each scale has a spot of brown, those on the lateral line being larger and darker. Some have silvery cheeks, others are puncticulate with brown on the sides of the head. The longitudinal bar of silvery above the lateral line when present becomes indistinct in its forward half. Pectorals dusky; other fins freckled with brownish toward their bases. A darker spot on the basal portions of the hindmost rays of the dorsal; a darker bar across the bases of the rays of the caudal; caudal in the majority of cases tipped with a narrow border of black. The specimens described are from the Rio Grande del Norte, the locality furnishing the original description of Baird and Girard, and from the Chihuahua, whence Girard's specimens of *C. eximius* were brought. The Chihuahua representatives are lighter in colors, but otherwise furnish no reasons for separation from those of the Rio Grande.

Cyprinodon macularius.

Cyprinodon macularius B. & G., 1854, P. Phil. Ac., VI, 389; Grd., 1859, Mex. Bd. Fish, 68, pl. 37, f. 8–11; Blk., 1860, Cypr., 484; Trosch., 1865, Verz. Wirb. Mex., 104; Jor. & C., 1877, B. Buf. Soc., III, 141; Jor., 1878, B. U. S. G. Sur., IV, 432, — 1887, R. U. S. F. Com., 835; Jor. & G., 1882, B. 16 U. S. Mus., 330; Eig., 1892, P. U. S. Mus., XV, 142; Gilb., 1893, N. Am. Fauna, No. 7, p. 232.

Cyprinodon californiensis Grd., 1859, P. Phil. Ac., 157; Blk., 1860, Cypr., 484; Jor. & C., 1887, B. Buf. Soc., III, 141; Jor., 1878, B. U. S. G. Sur., IV, 432, — 1887, R. U. S. F. Com., 835; Jor. & G., 1881, P. U. S. Mus., III, 457, — 1882, P. U. S. Mus., IV, 42, — B. 16 U. S. Mus., 330; Jor. & J., 1882, P. U. S. Mus., IV, 13; Eig., 1888, W. Am. Sci., V, No. 1, p. 3.

Cyprinodon nevadensis Eig., 1889, P. Cal. Ac., (2) I, 270.

B. 6; D. 11–10; A. 11; V. 7 (rarely 6, or absent); P. 15; Ll. 27–29; Ltr. 11–10; Vert. 12+14.

In the young stages this species resembles *C. elegans;* large specimens,

however, do not retain the elongate form of that species, but become much deeper and more like *C. variegatus*, and they lose their markings in a nearly uniform light olivaceous. On a two inch specimen the depth is one third and the head one fourth of the total length. Body compressed; caudal pedicel deep. Head short, thick, nearly as wide as deep from the occiput; crown arched, rather pointed. Snout short, blunt, as long as the eye; chin steep. Mouth medium, oblique, opening upward; lower jaws longer; upper short, protractile. Eye large, three tenths of head, two thirds of forehead. Origin of dorsal about midway from snout to base of caudal. Anal origin under hind half of base of dorsal. Ventrals small, most often with seven rays, occasionally with six on one side or the other, sometimes six on each side; one or both of the fins are occasionally lacking. Caudal short, deep, truncate to slightly convex.

The smaller individuals are brownish on the back, more or less clouded and mottled, and have a series of irregular brown blotches along the lateral line, sometimes divided into two series by a longitudinal band of silver color on the lower half of the flank. In cases the blotches on the flank are confluent into a brown band. Fins clouded or puncticulate with brownish; hind rays of dorsal with a darker spot, not always present; caudal, and frequently the dorsal and anal, tipped with black. With age the markings on the scales are lost and the coloration becomes nearly or quite uniform olivaceous, light to dark, with or without lighter centres to the scales, while the entire body takes on a metallic tint that varies in individuals from silvery to golden. Ventral surfaces lighter, bright to dingy.

Colorado River basin to the Pacific Coast.

Cyprinodon Baileyi.

Cyprinodon macularius baileyi Gilb., 1893, N. Am. Fauna, No. 7, 233.

"Eleven immature specimens from Pahranagat Valley, Nevada, show no trace of ventral fins. They are olivaceous above, bright silvery on the lower half of sides and below, and have two lengthwise series of coarse black spots, one along middle line of body, the other on a level with the lower edge of caudal peduncle. The anal fin is larger than in typical *macularius*, the eleven specimens having each 13 rays instead of 10 or 11, as constantly in the latter. The material is insufficient to fully decide the status of this form. Except in the characters noted it agrees in proportions and formulæ with *macularius*."

Cyprinodon carpio.

Plate I. Fig. 3, teeth.

Cyprinodon carpio Gth., 1866, Cat., VI, 306; Jor. & G., 1882, B. 16 U. S. Mus., 330; Jor., 1887, R. U. S. F. Com., 835; Hensh., 1891, B. U. S. F. Com., IX, 374.

Cyprinodon mydrus G. & B., 1883, P. U. S. Mus., V, 433; Jor., 1885, P. U. S. Mus., VII, 110, — 1887, R. U. S. F. Com., 835.

B. 6; D. 12 (11–13); A. 10 (10–9); V. 7; P. 16–17; Ll. 25–26; Ltr. 10; Vert. 10+13.

This species does not appear to reach as great a depth in comparison with the length as *C. variegatus;* its head is more angular at the sides and more regularly arched from snout to dorsal, and its scales are larger and thicker. On an individual of two and five eighths inches the depth is little more than a third of the total, and the length of the head is little more than a third of the length to the base of the caudal. The arch from the mouth to the origin of the dorsal is quite regular. Snout short, blunt; chin not so steep as in *C. variegatus.* Mouth medium, below the level of the lower edge of the orbit, slightly directed upward. Teeth in a single series, tricuspid. Lower jaws longer, firmly united; upper shorter, protractile. Eye large, two sevenths of head, three-fourths of forehead, nearly as long as snout. Orbits prominent at the sides of the crown, which is a trifle concave transversely.

Dorsal origin about midway from snout to base of caudal. Anal origin below hindmost rays of dorsal; base short, rays elongate; fin narrow and extending farther back than the dorsal about half the length of the posterior ray, or to the short rays of the caudal. Pectoral reaching behind bases of ventrals. Length or depth of caudal, or depth of pedicel, about two thirds of the length of the head.

Olivaceous, light on the flanks, lighter below, with or without longitudinal streaks of lighter across the middle of the scales. Smaller specimens have a spot on each scale of several rows on the back, forming vittæ. Cheeks silvery. Specimens of an inch and three quarters are grayish on the back with groups of small spots marking the positions of five or six transverse blotches on the way to disappearance. The sides and below are silvery. The flanks are crossed by six or eight faint bands of darker, one of them crossing the bases of the caudal rays. Dorsal and caudal puncticulate with brown. Longitudinal streaks of light color on the sides. Others of this

length are more nearly uniform in color. An individual of about one inch has the dorsal blotches more distinct and separated from the lateral by a light stripe, below which there is a series of eight triangular or v-shaped blotches, some of which coalesce. Below the eye downward and forward a brown spot extends to the chin. On the cheeks, snout, and top of head there are dots or mottlings of darker.

Florida to Texas.

Cyprinodon Floridae.

Plate I. Fig. 4, teeth.

Jordanella Floridæ Goode, 1880, P. U. S. Mus., II, 117; Jor. 1881, P. U. S. Mus., III, 20,—1885, P. U. S. Mus., VII, 322; Jor. & G., 1882, B. 16 U. S. Mus., 328; Hensh., 1891, B. U. S. F. Com., IX, 374; Woolm., 1892, B. U. S. F. Com., X, 294, 296, 298, 300, pl. 52, fig. 4.

B. 5; D. 17 (16–18); A. 12 (11–13); V. 6; P. 14; Ll. 25–27; Ltr. 11–10; Vert. 13+14.

Body and head compressed; crown flattened; caudal pedicel deep, tapering more, in a lateral view, than on other species; back arched, descending gradually toward the caudal from the origin of the dorsal. Depth one third of total length; head one third of distance from snout to base of caudal. Snout short, blunt; chin steep. Mouth medium, oblique, opening upward; lower jaws longer, firmly united; upper shorter, protractile. Teeth in a single series on each jaw, tricuspid. Eye large, one third longer than snout, one third of head, nearly as wide as forehead. Dorsal elongate, originating about midway from the middle of the eye to the base of the caudal; base little shorter than head, extending little backward of that of anal; first ray strong, spine-like, following rays weak and slender. Anal small, originating in front of a vertical from the middle of the dorsal base. Ventrals small, not reaching anal. Pectorals reaching bases of ventrals. Caudal large, convex on hind margin. Scales large, humeral scales larger. Intestine nearly thrice the length of the body.

Brownish to olivaceous, with a series of six or eight brown transverse blotches on the back, and another series, opposite those of the former, along the lateral line; with a black spot below the eye; with or without a blackish spot on the hindmost rays of the dorsal; and with a large blackish spot, in the lateral series, on the middle of the side below the dorsal spine. Fins, body, and head, with puncticulations of brown. Belly and lower parts of head whitish. In life there were longitudinal streaks of lighter color on the flanks.

The length of the dorsal fin and the slenderness of the rays behind the first serve to distinguish this species from any other of the genus.

Florida.

Cyprinodon Martæ.

Cyprinodon Martæ Steind., 1876, Sb. Ac. Wien, LXXII, 1875, extr. p. 60; Jor., 1887, P. U. S. Mus., IX, 564.

D. 9; A. 10; V. 7; P. 16; Ll. 26; Ltr. 9.

Depth three and a half, and length of head four times the length of the body. Eye three, snout three and two thirds, and forehead twice the length of the head. Snout blunt. Teeth in a single row, tricuspid. Dorsal origin a half length of the head nearer the insertion of the caudal than to the end of the snout. Anal origin below the middle of the base of the dorsal. Rays of dorsal and anal elongate in the male, those of the anal reaching the short rays of the caudal. Base of ventrals nearer to snout than to caudal; longest ray as long as the head, reaching the anterior rays of the anal. Pectorals as long as the head, reaching backward of the bases of the ventrals.

Front edge of the dorsal, on the male described, blackish; three to four of the hindmost rays of dorsal and anal banded alternately with light and dark; the bands appear on the basal fourth and less distinctly on the anterior rays. Two to three darker transverse bands on the caudal, hindmost broadest. Back gray; sides silver-white.

Santa Marta, near the mouth of the Magdalena River. (Steindachner).

Cyprinodon amazona.

Cyprinodon amazona Eig., 1894, Ann. N. Y. Ac., VII, 627.

"D. 9 or 10; A. 12.

"Scales 21 in the male, 24 or 25 in the females. Depth, 4–5; head, $3\frac{1}{2}$–4. Eye large, longer than snout, 3 in head. Dorsal but slightly behind ventrals; anal much behind dorsal. Snout pointed. A silvery lateral band from above the eye to the middle caudal rays. Above and below this are brown bands extending the whole length to end of caudal, the lower one forward to tip of snout. Male with a third dark band from the base of the pectoral to the tip of the first anal rays. Types: 18 specimens (one a male?); up to 23 mm. long. Lower Amazonas." From the description alone it is hardly worth while to attempt determination of the distinctions between this

species and *C. Martæ*, if they are distinct, or whether either is properly placed in Cyprinodon. The shape of the body approaches that of Lebias, or Jenynsia.

LEBIAS.

Plate I. Fig. 5-6, teeth.

"*Les Lebias*" Cuv., 1817, R. An., II, 199.

Lebias Goldf., 1820, Handb. Zool., II, 16; Flem., 1822, Phil. Zool., II, 386; Latr., 1825, Fam. R. An., 123; Val. 1828, Humb. Obs., II, 159; Rüpp., 1828, Atl. Fische, 66; Wagn., 1828, Isis, XXI, Col. 1055; Cuv., 1829, R. An., II, 280, — 1836, R. An., I, 533; Schinz., 1836, Abb., 216; Swains., 1838, Classif., I, 89; Guer., 1838, Icon. Poiss., 28; Heck., 1844, Russeg. Reisen, I, 1089, — 1849, II, 268.

Aphanius Nardo, 1827, Prodr. Adriat. Ichth., 17.

Pœcilia (part) McClell., 1839, Cypr., As. Res., XIX, 301.

Cyprinodon Cuv., 1817, R. An., II, 199, — 1829, l. c., 281, — 1836, l. c., I, 533; Val., 1828, Humb. Obs., II, 164, — 1846, C. V. Poiss., XVIII, 145; Schinz, 1836, Abb., 217; Guer., 1838, Icon., 29; Stor., 1846, Syn., 183, — Mem. Am. Ac., 435; Dum., 1856, Ichth., 410; Blkr., 1860, Cypr., 481, 484, — 1863, Atl., III, 139; Gthr., 1866, Cat., VI, 301, — 1880, Intr., 614; Day, 1873, Burm., 276, — 1878, Fish Ind., 521; Jor. & G., 1882, B. 16 U. S. Mus., 328; Seel., 1886, Fish. Eur., 22, 369.

Micromugil Gulia, 1861, Tent. Ichth. Melit., 11.

Form moderately elongate, compressed, caudal pedicel deep. Crown flattened. Snout short, blunt; chin steep. Mouth small, directed upward; lower jaws longer, firmly united; upper short, protractile. Teeth in a single series in each jaw, compressed and broadened toward the crowns, tricuspid. Gill membranes united, free from the isthmus. Branchiostegal rays five to four. Dorsal fin originating in the posterior half of the length; first ray not enlarged. First ray of anal farther backward than that of dorsal; fin not modified on the male. Ventrals small; rays five to seven. Caudal large, deep. Intestine short to medium. Rather smaller than Cyprinodon.

Mediterranean region in Europe, Africa, and Asia Minor to India.

It seems to have been the intention at first to name this genus Lebia. That name being preoccupied the added "s" was adopted. In a number of instances of the synonymy species of Cyprinodon were included.

Lebias calaritana.

"*Pœcilia calaritana* Bonelli," Cuv., 1829, R. An., ed. 2, II, 280, — 1840, ed. ill., 228.

Lebias calaritana Cuv., 1829, R. An., II, 280; Costa, 1839, Fauna Napol., Addom. Malacott., 33, pl. 17, fig. 2; Bonap., 1846, Cat. Met., 25; Canestr., 1866, Arch. Zool., IV, 125, — 1872, Fauna Ital., III, 19; Doderl., 1879, Atti Ac. Sci. Pal., (2) VI, 56; Lepori, 1881, Ann. Sc. Nat. Modena, (2) Ann. 15, p. 32, — Atti R. Acc. Linc. Trans., V, 195, — Mem. Cl. Fis., IX, 481.

Aphanius nanus Nardo, 1827, Ichth., pp. 17, 23, — Isis, XX, for 1827, 482, 488, and Brugnat. Giornale, X, for 1827.

Lebias flava Costa, 1839, Fauna Napol., Pesci, Add. Malac., 35, pl. 17, fig. 1.

Cyprinodon calaritanus Val., 1846, C. V. Poiss., XVIII, 151; Bellot., 1858, Mem. Ac. Tor., XVII, p. clix; Blk., 1860, Cypr., 484; Gth., 1866, Cat., VI, 302; Playf. & Let., 1871, Ann. Mag., VIII (4), 389;

Bean, 1880, P. U. S. Mus., II, 32; Sauv., 1880, Nouv. Arch., III (2), 6, 15, — 1882, Revoil, Faune et Flore, 6; Vincig., 1884, Ann. Mus. Gen., XX, 441; Seel., 1886, Fish. Eur., 22, 369.

Cyprinodon Moseas Val., 1846, C.V. Poiss., XVIII, 168, pl. 528; Heck., 1849, Ichth. Russeg., II, 326, 330; Blk., 1860, Cypr., 484.

Cyprinodon Hammonis Val., 1846, C.V. Poiss., XVIII, 169; Heck., 1849, Ichth. Russeg., II, 321, 323, 329; Mart., 1858, Wiegm. Arch., XXIV, 155, pl. 4, fig. 5; Blk., 1860, Cypr., 484.

Cyprinodon ammonis Sauv., 1882, Revoil, Faune et Flore, 10.

Cyprinodon cyanogaster Guich., 1859, Rev. & Mag., 378; Gerv., 1866, Compt. rend., LXIII.

Cyprinodon doliatus Guich., 1859, Rev. & Mag., 379; Gerv., 1866, Compt. rend., LXIII.

Cyprinodon dispar Gth., 1859, P. Z. S. Lond., 470, 474.

Var. **fasciata**.

Lebias fasciata Val., 1828, Humb. Obs., II, 160, pl. 51, f. 4; Wagn., 1828, Isis, XXI, 1055; Cuv., 1829, R. An., II, 280.

Aphanius fasciatus Nardo, Isis, XX, for 1827, 482, 488, — Ichth., pp. 17 & 23.

Cyprinodon fasciatus Val., 1846, C.V. Poiss., XVIII, 156; Mart., 1858, Wiegm. Arch., XXIV, 153, pl. 4, fig. 4; Gth., 1866, Cat., VI, 303; Sauv., 1882, Revoil, Faune et Flore, 8.

Lebias lineato-punctata Wagn., 1828, Isis, XXI, 1055, pl. 12, fig. 1–6.

Lebias nigropunctata Bonap., 1841, Fauna Ital. Pesci.

Lebias sarda Wagn., 1828, Isis, XXI, 1055, pl. 12, fig. 7.

Cyprinodon calaritanus var. *fasciatus* Seel., 1886, Fish. Eur., 22, 370.

B. 5; D. 12–10; A. 11–10; V. 7–6; P. 15; Ll. 26–27; Ltr. 8–9; Vert. 13+13.

Form moderately elongate and compressed, depressed on head and nape. Head as wide as deep, length equal depth of body, less than one third of the length from snout to base of caudal; crown broad, very little arched. Snout shorter than eye, blunt, broadly rounded; chin steep. Mouth moderately large, opening directed upward; lower jaws longer; upper short, protractile. Eye large, longer than snout, one third of head, two thirds of forehead. Dorsal origin about midway from occiput to base of caudal, or half way from snout to end of caudal. Anal origin below fourth or fifth ray of dorsal. Ventrals small, not reaching anal. Pectorals hardly reaching a vertical from the bases of the ventrals. Fins rounded. Caudal deep, subtruncate to slightly concave on the hind margin, nearly as long as the head. Ventrals with six rays, apparently, are rare.

Silvery, brownish on the upper half of the body and head. With nine to a dozen narrow brownish bands across the flank; the hindmost commonly including a small spot of blackish at the root of the caudal. Frequently the vertical bands are so short that they may be described as a series of vertical spots along the middle of the side. Under each scale of the flank, specimens from Venice show one to several short lines that from scale to scale form four or five longitudinal streaks of whitish. On these specimens the transverse bars extend farther toward the median lines of back or belly than on the species proper, which is the principal reason for separating them under the variety name *fasciata*.

Günther says the males have nine or ten silvery cross bars, each about as broad as a scale, black anterior dorsal rays, and a blackish band across the hinder half of the caudal; and that the females are silvery on the side with more or less numerous narrow black vertical stripes, which do not extend on to the back or to the belly; while in the young the cross bars and stripes are as frequently present as absent.

Southern Europe; Sardinia; Northern Africa.

Lebias iberus.

Cyprinodon iberus Val., 1846, C.V. Poiss., XVIII, 160, pl. 528, fig. 1, male; Heck., 1849, Ichth. Russeg., II, 267; Blk., 1860, Cypr., 484; Playf. & Let., 1871, Ann. Mag., VIII (4), 390; Sauv., 1882, Revoil, Faune et Flore, 9; Vincig., 1884, Ann. Mus. Civ. Gen., XX, 441; Scel., 1886, Fish. Eur., 22, 370.

Lebias ibericus Steind., 1865, Sb. Ak. Wien, LII, 483, pl. fig. 1–2; Bean, 1880, P. U. S. Mus., II, 32.

B. 5; D. 10–11; A. 11–10; V. 6; Ll. 26; Ltr. 8; Vert. 12+14.

Shape similar to that of *L. calaritana*. Body compressed, depth about equal to length of head, which is two sevenths of the length to the caudal base. Head as wide as deep, little less than one fourth of the total length; crown flat. Snout short, half as long as the eye, blunt; chin steep, nearly vertical. Mouth moderate, opening obliquely upward; lower jaws longer; upper short, protractile. Eye large, twice the snout, once the forehead, two fifths of the head. Dorsal origin slightly in advance of the middle of the total length, about midway from occiput to base of caudal. Origin of anal below third or fourth ray of dorsal. Ventrals small, six-rayed. Pectorals reaching a vertical from the bases of the ventrals. Outer margins of dorsal, anal and caudal convex. Intestine about one and one half times the total length.

Light brownish or olivaceous; belly and lower half of head silvery. Darker specimens with a silvery band faintly indicated along the lateral line. Females with three or four longitudinal series of small spots of brown along the sides. The hindmost spot, on the middle of the base of the caudal, is commonly black. On the caudal, near the spot, there is most often a faint transverse band and the tip of the fin is somewhat dark. The fins are dotted or uniform. The male has numerous, 12–16, narrow bands across the sides, and one to three brownish to black ones across the caudal.

The specimens described are from Barcelona, Spain.

Lebias punctatus.

Plate I. Fig. 6, teeth.

Lebias punctatus Heck., 1849, Russeg. Reisen, II, 268, pl. 22, fig. 3.
Cyprinodon punctatus Blk., 1860, Cypr., 484; Gth., 1866, Cat., VI, 305.
Lebias crystallodon Heck., 1849, Russeg. Reisen, II, 269, pl. 22, fig. 4.
Cyprinodon crystallodon Blk., 1860, Cypr., 484.

D. 10–11; A. 11–10; V. 6; P. 15; Ll. 26–27; Ltr. 8; Vert. 13+13.

Body stout, moderately compressed and elongate, depth little more than length of head. Head about three and one third times in the length to the caudal base, crown nearly flat. Snout shorter than the eye, blunt; chin steep. Mouth moderate, directed obliquely upward; lower jaws longer; upper short, protractile. Eye large, one third longer than the snout, one third of head, three fourths of forehead. Dorsal origin midway from head to base of caudal or half way from snout to end of caudal. Anal origin below third or fourth ray of dorsal. Ventrals small, not reaching anal. Pectorals short, not reaching bases of ventrals. Fins rounded. Caudal convex.

Silvery, brownish on back, brown on top of head, with numerous small spots of brownish, arranged in three or more, more or less irregular, longitudinal series, the median of which, on the lateral line, commonly ends in a black spot on the middle of the base of the caudal. On some this median series is entirely composed of blackish spots. Rarely the spots are somewhat confluent into longitudinal bands. Brownish specimens show a longitudinal band of silvery along the middle of the flank. The form described as *L. crystallodon* has spots only toward the base of the caudal, around the black spot usually ending the median series.

Nemek-Deria, a salt-water lake near Schiraz.

Lebias Sophiae.

Plate I. Fig. 5, teeth.

Lebias Sophiae Heckel, 1849, Ichth. Russeg. Reisen, II, 267, pl. 22, fig. 2.
Cyprinodon Sophiæ Blk., 1860, Cypr., 484; Gth., 1866, Cat., VI, 304.
Cyprinodon Danfordii Blgr., 1890, Ann. Mag. N. H., (6) VI, 169.

B. 5; D. 13–12; A. 11; V. 5–6; P. 15; Ll. 27–28; Ltr. 8; Vert. 13+14.

Moderately stout, compressed. Depth of body and length of head nearly equal, one third to two sevenths of the length to the base of the caudal. Snout shorter than the eye, blunt; chin nearly vertical. Mouth medium, directed upward; lower jaws longer; upper short, protractile. Eye large,

longer than snout, nearly equal width of forehead, one third of head. Dorsal origin about midway from occiput to base of caudal, or nearly half way from snout to end of caudal. Anal origin below the fourth or fifth ray of the dorsal. Ventrals small, most often with five rays. Pectorals reaching a vertical from the ventrals. Caudal convex.

Brownish, with twelve to seventeen narrow bands of silvery crossing the flanks. Fins brownish to blackish; in cases with light borders on dorsal, caudal, and anal. Anal of some specimens with silvery dots on the basal half. Günther gives the colors of the male as dark greenish brown, with silvery dots on the caudal portion of the trunk; fins black, dorsal and anal with two oblique series of white spots. Females and young according to him are light brownish green, with numerous silvery vertical streaks; fins transparent, colorless.

Persia; Syria; Dead Sea.

Lebias mento.

Lebias mento Heckel, 1844, Ichth. Russeg. Reisen, I, 1089, pl. 6, fig. 4.
Cyprinodon mento Val., 1846, C. V. Poiss., XVIII, 171; Blk., 1860, Cypr., 484; Gth., 1866, Cat., VI, 305.
Lebias cypris Heck., 1844, Ichth. Russeg. Reisen, I, 1090,— 1849, Vol. II, 242, pl. 19, fig. 1.
Cyprinodon cypris Blk., 1860, Cypr., 484; Gth., 1866, Cat., VI, 304.

B. 4; D. 11–12; A. 11–10; V. 5–6; P. 15; Ll. 26–28; Ltr. 8.

Short and stout, head and body compressed, caudal pedicel short, deep. Head short, less than depth of body, nearly two sevenths of length to base of caudal, deeper than wide, arched across the forehead. Snout shorter than the eye, blunt; chin nearly vertical. Mouth small, opening obliquely upward; lower jaws longer, firmly joined; upper short, protractile. Teeth strong, firmly set, tricuspid. Eye large, two sevenths of head, two thirds of interorbital space, longer than snout. Dorsal origin midway from eye to base of caudal. Anal origin below posterior half of base of dorsal. Ventrals small, hardly reaching anal aperture, commonly five rayed. Pectorals small, reaching a vertical from the ventrals. On males dorsal and anal are somewhat farther forward. Caudal deep, convex. I find but four branchiostegal rays on each side of a specimen dissected.

Olivaceous, light grayish to greenish; sides, belly, and lower half of cheek silvery. Fins plain or clouded, or with transverse series of small dots of dark color. Occasionally specimens are found that are sprinkled over head and body with small dots of black. Originally described from Mossul. Appa-

rently the description of *L. cypris* was drawn from small, and that of *L. mento* from larger individuals. Heckel says the belly of *L. mento* is yellowish white, the back brown; the males are darker and have black fins with white dots; the females lighter with uniform white or yellowish white fins. Günther identifies the species *L. cypris* from Bagdad and the Jordan.

"Lac de Damas."

Lebias dispar.

Lebias dispar Rüppell, 1828, Atl., Fische des rothen Meeres, 66, pl. 18, fig. 1–2; Val., 1846, C. V. Poiss., XVIII, 167; Heck., 1849, Ichth. Russeg., II, 323, 329, 330.

Cyprinodon lunatus Val., 1846, C. V. Poiss., XVIII, 161; Heck., 1849, Ichth. Russeg., II, 321, 323, 329; Blk., 1860, Cypr., 484.

Cyprinodon hammonis Rich., 1856, P. Z. S. Lond., 371.

Cyprinodon dispar Gth., 1866, Cat., VI, 303; Klzg., 1871, Verh. Ges. Wien, XXI, 587 (Synops. 147); Day, 1878, Fish. Ind., 521, pl. 121, fig. 1–2; Sauv., 1880, Nouv. Arch., III (2), 15; Vincig., 1884, Ann. Mus. Gen., XX, 442; Blgr., 1887, P. Z. S. Lond., 666, — 1890, Ann. Mag. N. H., (6) VI, 169.

Cyprinodon Stoliczkanus Day, 1872, J. As. Soc. Beng., 258, — 1873, Fish. Ind. and Burm., 276; Beavan, 1877, Fish. Ind., 155.

B. 5; D. 8–9; A. 10; V. 7; Ll. 25–26; Ltr. 8; Vert. 12 + 14.

Body and head compressed, caudal pedicel deep. Head thick, two sevenths of the length to the base of the caudal; crown broad, slightly arched. Snout short, two thirds of eye, blunt; chin moderately steep. Mouth small, directed obliquely upward; lower jaws longer; upper short, protractile. Eye large, longer than snout, two thirds of forehead, one third of head. Dorsal small, origin midway from head to base of caudal, or half way from snout to end of caudal. Anal origin below middle of dorsal. Ventrals small, not reaching anal. Pectorals nearly reaching bases of ventrals. Caudal truncate or slightly concave on hind margin. Dorsal and anal rays longer in males, fins a trifle farther forward. Eleventh scale of the lateral line below the origin of the dorsal.

Sides and lower surfaces silvery, tinted with greenish in life; back brownish. With or without narrow bars of brownish crossing the sides. With or without freckles or reticulated markings of brownish. Fins of females nearly uniform light to clouded. On males the dorsal is sometimes thickly covered with small spots of black, and the anal, as figured by Rüppell and Day, has four or five bars of black across its posterior half, the anterior half being red or orange. The caudal of this sex has two or three transverse bands of brown or of black.

Abyssinia and Asia Minor to India.

TELLIA.

Tellia Gerv., 1853, Ann. Sc. Nat., XIX, 15, Extr. p. 10; Blk., 1860, Cypr., 481; Gth., 1866, Cat., VI, 308.

Tellianini Blk., 1863, Atl., III, 139.

In form and general characters this fish agrees with Lebias, but it lacks the ventral fins. The relations existing between Tellia and Lebias are somewhat similar to those existing between Fundulus and Empetrichthys. The affinities of *Tellia apoda* and *Lebias calaritana* are such as to suggest a possible derivation from the latter.

Algiers.

Tellia apoda.

Tellia apoda Gerv., 1853, Ann. Sc. Nat., XIX, 15,—1866, Compt. Rend., LXIII, Val., 1858, Compt. Rend., XLVI, 715; Blk., 1860, Cypr., 484; Gth., 1866, Cat., VI, 309; Playf. & Let., 1871, Ann. Mag. N. H., VIII (4), 390; Sauv., 1880, Nouv. Arch. Mus., III (2), 6, 15.

D. 15; A. 13.

Body compressed; head rather large. Mouth opening obliquely upward. Teeth in a single series in each jaw, tricuspid. Dorsal origin a little in front of the posterior third of the length of the body. Caudal convex.

"La couleur parait grisâtre, mais elle est relevée chez plusieurs individus de bandes brunes verticales, rappelant celles des *Cyprinodon* [*Lebias*] *calaritanus* et *fasciatus*."

Head waters of the River Tell. (Gervais.)

CHARACODON.

Characodon Günther, 1866, Cat., VI, 308.

Shaped like some of the more elongate species of Cyprinodon. Body and head compressed; caudal portion moderately deep; back somewhat regularly arched. Mouth medium, directed upward; upper jaw protractile; mandibles short, firmly united. Teeth in bands; outer series larger, chisel-shaped, with a notch forming two cusps; inner small. Eye lateral, rather large. Dorsal and anal behind the middle, opposed. Intestine not much convoluted.

Central America; Cape San Lucas; Coahuila, Mex.

Characodon lateralis.

Plate I. Fig. 9, teeth.

Characodon lateralis Gthr., 1866, Cat., VI, 308, —1868, Tr. Zool. Soc., VI, 480, pl. 82, fig. 2; Eig., 1893, P. U. S. Mus., XVI, 56.

Characodon bilineatus Bean, 1888, P. U. S. Mus., X, 371, pl. 20, fig. 2; Eig., 1893, l. c., 56.

Characodon variatus Bean, 1888, l. c., 370, pl. 20, fig. 1, —1892, P. U. S. Mus., XV, 286; Eig., l. c., 56; Woolm., 1894, B. U. S. F. Com., 62.

Characodon ferrugineus Bean, 1888, P. U. S. Mus., X, 372, pl. 20, fig. 3, 4; Eig., l. c., 56.

B. 4; D. 12; A. 12; V. 6; P. 17; Ll. 32; Ltr. 11–12; Vert. 15+18.

Body compressed, moderately stout, caudal pedicel deep, back gently arched. Head about one third of length to base of caudal; very little arched transversely. Snout short, not as long as the eye; chin steep. Mouth medium; upper jaw protractile. Teeth in outer series bicuspid. Eye large, nearly equal to interorbital space, one third longer than snout, two sevenths of head. The specimen examined had four branchiostegal rays on each side, whether this is normal must be decided from others. Fins small; dorsal origin about five sevenths of the distance from snout to caudal; anal opposed to dorsal; posterior margin of caudal subtruncate.

Olive to reddish brown, with scattered small spots of darker on the back, a darker band with or without spots of dark along the flank, more distinct posteriorly. Fins with fine dots of dark color.

Originally discovered in Central America; here described from Parras, Coahuila, Mexico.

Characodon furcidens.

Characodon furcidens J. & G., 1883, P. U. S. Mus., V, 354, 371; Jor., 1886, P. U. S. Mus., VIII, 368, —1887, Rep. U. S. F. Comm., 836; Eig., 1893, P. U. S. Mus., XVI, 56.

D. 15–17; A. 13; Ll. ca. 50; Ltr. 15.

Comparatively elongate, not greatly compressed. Head rather low, broad, depressed. Caudal peduncle somewhat long and slender, about length of head. Anterior teeth larger, bicuspid. Eye three tenths of head. Interorbital space nearly half of head. Origin of dorsal midway from base of pectoral to caudal; fin low, not as high as long; base three fifths of the length of the head. Anal originating below seventh dorsal ray. Pectorals three fifths, and ventrals one half as long as the head. Caudal subtruncate, upper lobe a little the longer.

Males mottled with darker on the flanks, or plain. Vertical fins each with several bars of brownish, and a dusky subterminal bar. A narrow streak of dark along the middle of each scale on the back. Females with

several short bars of dark on the posterior half of the body; fins as on the male. Some spots of dark on the caudal pedicel.

Longest specimen three and one fourth inches.

Cape San Lucas, Lower California. (Jordan.)

Characodon Luitpoldii.

Characodon Luitpoldii Steind., 1894, Anz. Wien Akad., 147.

D. 13–14; A. 15–16; V. 6; P. 16; Ll. 39+4; Ltr. 16, above the vent.

Body elongate, compressed; caudal section deep. Head little more than four and one half times in the body length, or five and three fifths times in the total; forehead broad, flattened; upper profile slightly concave. Snout about three and one third, eye four and two fifths, and forehead two times in the length of the head. Mouth cleft directed upward; lower jaw longer; outer teeth biscuspid; inner small, pointed, in viliform bands.

"Die Rückenlinie steigt minder rasch und unter schwächerer Bogenkrümmung zur Dorsale an als die Bauchlinie vom vorderen Kopfende an bis in die Nähe der Ventrale sich senkt. Letztere Flosse in der Mitte der Rumpflänge eingelenkt. Der innere Ventralstrahl durch eine Hautfalte an den Bauchrand geheftet und zugleich auch in seiner vorderen Längenhälfte mit dem der entgegengesetzten Seite ähnlich wie bei den *Gobiinen* verbunden.

"Der Beginn der Anale fällt $1\frac{3}{4}$ bis nahezu 2 mal näher zur Caudale als zum vorderen Kopfende, der der Anale liegt ein wenig hinter dem Beginn der Dorsale. Caudale am hinteren Rand fast abgestutzt mit abgerundeten Ecken. Die unter der Mitte der Rumpfhöhe eingelenkte Pektorale um circa $\frac{2}{3}$ einer Augenlänge kürzer als der Kopf.

"Rumpfseiten dunkel silbergrau, jede Schuppe derselben im mittleren Theile mit einem helleren Fleck. Schuppen an der Oberseite des Kopfes durch besondere Grösse ausgezeichnet.

"Patzcuaro-See in Mexico." (Steindachner.)

Largest specimen 13.6 *cm.* On comparison it may be this species will have to be united with *C. furcidens.*

? Characodon atripinnis.

Goodea atripinnis Jor., 1880, P. U. S. Mus., II (1879), 300; J. & G., 1882, Bull. 16 U. S. Mus., 348.
Characodon atripinnis Bean, 1888, P. U. S. Mus., X, 370; Eig., 1893, P. U. S. Mus., XVI, 56.

D. 12; A. 13; Ll. 37–40; Ltr. 13.

Body compressed, back nearly straight, caudal pedicel deep. Head

depressed, broad, short, one fourth of the length. Mouth small; lower jaw prominent. Teeth small, tricuspid. According to Bean the small inner teeth were overlooked in the original description. Eye two sevenths of the head, little more than half of the interorbital space. Fins small; dorsal slightly in advance of anal; caudal short; pectorals not reaching the ventrals.

Bluish above; a silvery streak along each row of scales. Vertical fins chiefly black, especially on the distal half. Intestinal tract considerably convoluted, and filled with mud. From a salt lake in a volcanic basin.

Guanajuato, Mexico. (Jordan.)

The position of this species is still to be questioned. Bean says, "a recent examination of the types of *Goodea atripinnis* Jordan, proves the existence of villiform teeth behind the incisors, and throws *Goodea* into the synonymy of *Characodon*." Jordan says *Goodea* "differs from most of the other *Cyprinodontidæ* in its tricuspid teeth. From *Cyprinodon*, *Jordanella*, *Fitzroyia*, *Characodon*, and *Jenynsia*, the genera thus far known with tricuspid incisors, it is distinguished by the elongate intestines, and by the freeness of the dentary bones. The aspect is wholly unlike *Cyprinodon*, resembling rather *Fundulus*."

Characodon has two cusps on the teeth and has mandibles rather firmly joined. These are characters of more weight than the presence of viliform teeth. From the description, we should hesitate in placing the species *atripinnis* in Characodon; but, in deference to the more recent researches, it is provisionally allowed to remain there until we are able to examine specimens.

GIRARDINICHTHYS.

Girardinichthys Blkr., 1860, Cypr., 481, — 1863, Atl. Ichth., III, 139.
Limnurgus Gthr., 1866, Cat., VI, 309.

Compressed in body and head; caudal pedicel of moderate depth. Head short, narrow forward. Snout short, blunt, chin very steep. Mouth small, directed upward; lower jaws longer, firmly united; upper short, very protractile. Compressed teeth in the outer series. Gill openings wide; membranes short, partly united, free from the isthmus. Scales medium. Intestine short. Bases of dorsal and anal short, opposed, behind the middle of the body; rays numerous. Anal fin not modified in the male.

Mexico.

Girardinichthys innominatus.

Plate I. Fig. 11, teeth.

Lucania sp. Grd., 1859, P. Phil. Ac., 119.
Girardinichthys innominatus Blkr., 1860, Cypr., 484, — 1863, Atl., III, 139; Jor. & C., 1877, B. Buf. Soc., III, 142; Jor., 1878, B. U. S. G. Surv., IV, 411, 432; Eig., 1893, P. U. S. Mus., XVI, 56.
Limnurgus variegatus Gthr., 1866, Cat., VI, 309.

B. 5; D. 19; A. 24 (25); V. 6; P. 15; Ll. 40; Ltr. 15.

D. 20–21; A. 22–23; V. 6; Ll. 44 (Günther.)

Body and head compressed, back flattened anteriorly, arched from the occiput through the dorsal fin. Head one fourth of the length to the caudal fin, convex transversely, concave from orbit to nape, narrowing forward. Snout shorter than the eye, thick, blunt, very steep on the chin. Eye large, two sevenths of the head, two thirds of the interorbital space. The median teeth in the outer series resemble those of Characodon, the lateral are subconical. A few small hooked teeth behind the outer series. Dorsal origin midway from occiput to caudal, and little further back.

Olivaceous, dark to light, with more or less confluent transverse bands of brown on the flanks. Fins olivaceous, somewhat freckled or spotted with brown.

City of Mexico.

NEOLEBIAS.

Neolebias Steind., 1893, Notes Leyd. Mus., XVI, 78.

"Mundspalte klein, seitlich und horizontal entwickelt. Unterkieferhälften fest vereinigt. Zwei Zahnreihen im Zwischen- und Unterkiefer; Zähne der Aussenreihe gegen das freie Ende zu in 2 stark divergirende Aeste gespalten, Zähne der Innenreihe noch zarter, stark zugespitzt. Schnauze kurz (vorne stark oval gerundet), Anale hinter dem Ende der Dorsale in vertikaler Richtung beginnend. Ventrale unter dem Beginn der Caudale eingelenkt."

Neolebias unifasciatus.

Neolebias unifasciatus Steind., 1893, Notes Leyd. Mus., XVI, 78.

D. 10; A. 8; Ll. 34.

"Körperform gestrekt oval, stark comprimirt. Die obere Kopflinie erhebt sich mässig mit der Rückenlinie bis zum Beginn der Dorsale, hinter welcher sich die Rückenlinie fast ebenso gleichmässig bis zur Caudale senkt.

"Die Oberseite des Kopfes ist in der Stirngegend und am Hinterhaupte

querüber ein wenig gewölbt, etwas schwächer an der Schnauze, deren vorderer Rand stark oval gerundet ist. Die Mundspalte erhebt sich mässig nach vorne und ist im Verhältniss zu den Cyprinodon-Arten von geringer Breite am vorderen Ende. Der Zwischenkiefer überragt nicht nach vorne den Unterkiefer.

"Die grösste Rumpfhöhe zwischen dem Beginne der Dorsale und der Ventrale ist c. $3\frac{1}{2}$ — $3\frac{2}{5}$ mal, die kopflänge genau oder ein wenig mehr als 3 mal in der Körperlänge, der Augendiameter c. 3 mal, die Schnauzenlänge c. 4 mal in der Kopflänge enthalten. Die Stirnbreite steht der Augenlänge nach.

"Die Dorsale beginnt in der Mitte der Körperlänge, die Anale in vertikaler Richtung unter der Basis des letzten Dorsalstrahles, ebenso weit von der Basis der Caudale wie vom hinteren Kopfende entfernt. Die Ventrale ist genau unter oder nur ganz unbedeutend vor der Dorsale in vertikaler Richtung eingelenkt. Dorsal und Analstrahlen von keiner bemerkenswerther Höhe. Caudale am hinteren Rande eingebuchtet.

"Eine scharf abgegrenzte dunkelbraune Längsbinde zieht von dem vorderen seitlichen Ende der Schnauze längs der Mitte der Rumpfhöhe zur Basis der Caudale, an der sie mit einem intensiver gefärbten Fleckchen endigt.

"Mehrere Exemplare, bis zu 2 Cent. lang, von Robertsport, Liberia."
(Steindachner.)

PŒCILIINÆ.

GLARIDODON.

Body moderately elongate, compressed; caudal pedicel of moderate depth. Body cavity less than half of the total length. Head depressed, slightly arched. Snout short, blunt; chin steep. Mouth directed upward; lower jaws longer, firmly united; upper shorter, protractile. An outer series of broad-cusped, chisel-shaped, hooked teeth firmly set on each jaw and behind these a band of small ones, sharp pointed, expanded and hooked near the apex. Branchiostegal rays five. Dorsal origin behind the middle of the body, without the caudal, behind that of anal. Base of anal on female in part opposed to dorsal. Anal of male farther forward and modified into a long intromittent organ. Intestine long. Scales large. Type *G. uninotatus* from Cuba.

Radical differences in the structure of jaws and teeth and the presence of the viliform bands behind the outer series of teeth on the jaws compels the separation of this genus from Girardinus.

Glaridodon uninotatus.

Plate V. Fig. 10, teeth; Plate VIII. Fig. 14, male.

Girardinus uninotatus Poey, 1861, Mem., II, 309, 383,—1868, Repert., II, 411,—1876, An. Soc. Esp., V, 142; Gth., 1866, Cat., VI, 351; Jor., 1878, B. U. S. G. Sur., IV, 411.
Heterandria uninotata Jor., 1887, P. U. S. Mus., IX, 563.

B. 5; D. 10; A. 11; V. 6; P. 12–13; Ll. 28–30; Ltr. 9–8; Vert. 13 + 17.

Body elongate, compressed, arch of back low; caudal pedicel of moderate depth. Head short, two ninths of the length to the base of the caudal, slightly arched across the forehead. Mouth wide, arched in outline, directed upward; lower jaws longer, strong, firmly united; upper shorter, protractile. Snout short, blunt, two thirds of eye or half of interorbital space; chin steep. Teeth in the outer series stout, varying in shapes, slightly swollen at the base, broadened and shovel shaped at the apex, hooked, firmly set; in the inner series small, pointed, slightly broadened near the summit, hooked. Pharyngeal teeth slender, hooked, with a shoulder. Eye large, longer than snout, two thirds to three fourths of forehead, two fifths to one third of head. Dorsal origin near the middle of the total length, over third or fourth rays of anal in the female. Anal of male farther forward; anal process very long, one third of the total length of the fish. Ventrals and pectorals small; latter reaching a vertical from the origin of the anal in the male or the bases of the ventrals in the female. Caudal large, subtruncate or slightly convex on hind margin. Scales large. Intestine more than twice the total length.

Back olivaceous, sides silvery, belly lighter. A black spot on the twelfth to the fourteenth scales behind the head, above the vent, on the middle of the flank. Poey says of fresh specimens, "la couleur est d'un brun verdâtre, avec une grande tache arrondie sur les flancs, à l'aplomb de l'anus; un cercle noir entoure l'orifice anal; le tronc porte un réseau de points pigmentaires, qui disparaissent dans l'eau de vie." He found twenty-four embryos in one female. Our description is taken from his types.

Largest female three and three eighths and largest male one and seven eighths inches.

Cuba.

Glaridodon latidens sp. n.

Plate V. Fig. 11, teeth.

B. 5; D. 8; A. 10; V. 6; P. 12; Ll. 28–30; Ltr. 8; Vert. 13 + 19.

Moderately elongate, compressed, caudal pedicel comparatively deep. Head little more than depth, more than one fourth of the length to the base of the caudal, flattened on the crown. Snout short, blunt, rounded; chin very steep. Mouth rather wide, arched transversely, directed upward; lower jaws longer, firmly united; upper short, protractile. Teeth chisel shaped, hooked and strong in the outer series; inner teeth in bands, pointed, commonly expanded near the apex as if two or three cusped; pharyngeal varying in shapes, larger with hook and shoulder. Eye large, longer than snout, two thirds of forehead, one third of head. Dorsal origin little behind the middle of the total length, above the middle of the base of the anal. Ventrals very small, not reaching anal. Pectorals moderate, reaching behind bases of ventrals. Caudal as long as the head, subtruncate or convex. Scales large.

Light olivaceous, darker on back, silvery on opercles, throat, and belly, apparently somewhat lighter along the middle of the flank; with narrow vertical bars of brown on the sides, more distinct behind the abdomen, one of them situated below the hind extremity of the base of the dorsal. Fins clouded with brownish. Top of head dark. A dark line from anal to caudal; in cases a similar line on the middle of the side. The brown color is in puncticulations, sometimes arranged toward the edges of the scales.

Chihuahua, Mexico.

Glaridodon januarius.

Plate V. Fig. 8, teeth; Plate VIII. Fig. 15, male.

Girardinus januarius Hens., 1868, Arch. f. Nat., XXXIV, 360, — 1869, Arch. f. Nat., XXXV, 89; Eig., 1891, P. U. S. Mus., XIV, 65.

Pœcilia januarius Eig., 1894, Ann. N. Y. Ac., VII, 636.

Girardinus caudimaculatus Hens., 1868, Arch. f. Nat., XXXIV, 362, — 1869, Arch. f. Nat., XXXV, 89; Iher., 1883, Zeitsch. f. wiss. Zool., XXXVIII, 468, pl. 26; Eig., 1891, P. U. S. Mus., XIV, 65; Cope, 1894, Ann. N. Y. Lyc., VII, 636.

Girardinus iheringii Blgr., 1889, Ann. N. H., Oct., 266, Eig., 1891, P. U. S. Mus., XIV, 65.

? Gambusia gracilis Perug., 1891, Ann. Mus. Civ. Gen., X (2), 652.

Pœcilia caudomaculatus Eig., 1894, Ann. N. Y. Ac., VII, 636.

B. 5; D. 8–9; A. 9–11; V. 5–6; P. 10–12; Ll. 28–31; Ltr. 8; Vert. 14 + 18.

Form somewhat resembling that of *Gambusia Holbrookii*. Stout, well rounded, depressed anteriorly, compressed behind the head. Head nearly

equal depth between dorsal and anal, two ninths of the length to the base of the caudal, slightly arched on the crown. Snout short, less than eye, forming a nearly regular curve from orbit to orbit. Mouth small, narrow, directed upward; lower jaws longer, rather firmly joined; upper shorter, protractile. Outer series of teeth slender, narrowed at the base, broadened toward the apex, hooked; inner small, in bands, one cusped, with a slight expansion at each side near the point. Eye nearly twice in the snout, nearly three times in the head, one and one half times in the forehead. Dorsal origin about midway from head to base of caudal, about opposite that of anal. Anal of male farther forward, between the ventrals, intromittent portion little less than half the length of the body to the base of the caudal. Ventrals small, not reaching the anal, number of rays varying from five to six, in cases five rays on one side and six on the other. Pectorals small, reaching behind a vertical from the bases of the ventrals. Caudal deep, median rays longer than the head, convex.

Light olivaceous, edges of scales darker, lighter below. A lighter to silvery streak along the lateral line. Larger specimens nearly uniform, reticulated, belly silvery. Top of head darker; cheeks and throat silvery. About half the specimens are marked by a vertical spot of black, on the twelfth or thirteenth scale forward from the middle of the tail, little behind the base of the dorsal, on the middle of the flank. Commonly on the smaller specimens there are eight or more narrow vertical bars on the flank, the black spot appearing in one of them. Dorsal and caudal frequently and anal sometimes tipped with darker. A darkish transverse band in the dorsal and small spots on dorsal and caudal are not rare. Mature females one and one half, and males three fourths inches in length.

Maldonado; Rio Janeiro; Rio Negro; Campos; Muriahi; Santa Rita; Villa Nova; Santa Anna.

CNESTERODON.

These fishes are intermediate between Glaridodon and Girardinus. The mouth resembles that of Girardinus, but the teeth are broader and few in number. The incisors are broader and stronger than those of Glaridodon, but the jaws are not so firmly united. As seen in Plate VIII. Figs. 16, 17, the modification of the anal fin of the male differs from that of both Glaridodon and Girardinus, Plate VIII. Figs. 13–15, and approaches that of Gambusia. In the specimen dissected there were no subvertebral processes for

the support of the anal fin, Plate VIII. Fig. 16. Intestine elongate. Type, *C. decemmaculatus* from the Uruguay River.

Cnesterodon decemmaculatus.

Plate V. Fig. 13, teeth; Plate VIII. Fig. 16, male.

Pœcilia decemmaculatus Jen., 1842, Zool. Beagle, Fish, 115, pl. 22, fig. 1; Blk., 1860, Cypr., 486; Eig., 1894, Ann. N. Y. Ac., VII, 637.

Pœcilia gracilis Val., 1846, C.V. Poiss., XVIII, 133; Blk., 1860, Cypr., 486.

Girardinus decemmaculatus Gth., 1866, Cat., VI, 355; Heus., 1868, Arch. f. Nat., XXXIV, 364, — 1869, XXXV, 89; Perug., 1891, Ann. Mus. Civ. Gen., X (2), 653; Eig., 1891, P. U. S. Mus., XIV, 65.

B. 5; D. 8; A. 10–9; V. 6; P. 12; Ll. 31; Ltr. 8–9; Vert. 14+18.

This is evidently a small species; females of one and one eighth inches bear well developed young. The shape of the body bears some likeness to that of *Heterandria formosa*, on Plate XI. The length of the head is equal to the depth of the body, and is four fifteenths of the distance from snout to base of caudal. Crown slightly arched transversely. Snout short, about three fifths of the eye, broad, blunt. Mouth moderately wide, opening upward; lower jaws longer, somewhat firmly joined; upper short, protractile. Outer series of teeth rather broad and shovel-shaped, hooked; inner in a band, not numerous, very small, pointed, apparently with a slight expansion at each side near the apex; pharyngeal slender, hooked. Eye large, longer than snout, two fifths of head, three fourths of forehead. Dorsal origin nearly midway from eye to base of caudal, about opposite that of anal. On males the anal is farther forward, and modified into a long intromittent organ. On the specimen examined this organ is bladelike and without hooks, about one and one half times the length of the head or less than half as long as head and body without the caudal. Ventrals very small, rays sometimes five. Pectorals reaching the middle of the ventrals. Caudal elongate, deep, convex. Scales large, twelve between occiput and dorsal.

Light olivaceous, cheeks and throat silvery, belly silvery to golden. A series of irregular, more or less indistinct spots of dark color between the upper angle of the gill-opening and the middle of the caudal. Edges of scales darker. Tip of caudal sometimes darker. Some have a narrow streak of dark color on the middle of the caudal pedicel. In cases dorsal and anal are darker near their extremities.

Uruguay River; Maldonado.

Cnesterodon scalpridens sp. n.

Plate V. Fig. 12, teeth; Plate VIII. Fig. 17, male.

B. 5; D. 7; A. 9; V. 6; P. 11; Ll. 28–29; Ltr. 7; Vert. 14+15.

Elongate, moderately compressed, depth and length of head about equal, one fourth of the length, without the caudal. Snout short, blunt, rounded, not as long as the eye. Mouth narrow, oblique, directed upward; lower jaws longer, rather firmly joined; upper short, protractile. Teeth chisel-shaped, broad and close together in the outer series; inner series scattered in a band, small, tricuspid. There are eight incisors on each mandible. Eye large, longer than the snout, about three times in the head, or one and one half times in the forehead. Dorsal origin opposite that of anal, midway from occiput to base of caudal. Ventrals small, reaching the anal. Pectorals elongate, reaching the bases of the ventrals. Caudal large, longer than the head, subtruncate or slightly convex. Anal of male modified, longer than the head, much advanced. In this sex the second rays of the ventrals also are elongate. Scales large, intestine long.

Light olivaceous, edges of scales darker, lower half of cheek and belly silvery to golden. A faint streak of silvery, on a single row of scales, between the opercle and middle of the base of the caudal, frequently containing a black line. Top of head dark; top of snout light. Fins uniform, or dorsal puncticulate toward the base. The largest females measure one and one eighth inches; the largest males three fourths of an inch.

Amazon basin: Santarem; Obidos; Tapajos; Villa Bella; Trombetas.

GIRARDINUS.

Girardinus Poey, 1855, Mem., I, 383, 390,—1861, Mem., II, 383 (part),—1868, Repert., II, 411 (part); Blk., 1860, Cypr., 481, 484 (part),—1863, Atl., III, 139; Gth., 1866, Cat., VI, 351 (part).

Outlines similar to those of Gambusia. Body compressed, caudal pedicel deep, body cavity nearly half of the total length. Head depressed, broad and flattened on the crown. Snout broad, short; chin short, steep. Mouth wide, directed upward; jaws short, weak, loosely joined, lower longer, upper shorter, protractile. Teeth slender, movable, hooked, contracted at the base, broadened, spatulate or shovel-shaped, toward the apex, in a single series on each jaw without or with a few very small pointed teeth in bands behind them. Branchiostegal rays five. Dorsal fin behind the middle of

the body, without the caudal. Anal origin little farther forward than that of dorsal. Anal of male advanced, modified; anal process long, longer than the head, with hooks, or a clasper, at the end. Scales large. Intestine long.

West Indies.

Girardinus metallicus.

Plate V. Fig. 6, teeth; Plate VIII. Fig. 13, male.

Girardinus metallicus Poey, 1855, Mem., I, 387, 391, pl. 31, fig. 8–11, — 1861, Mem., II, 383, — 1868, Repert., II, 411, — 1876, An. Soc. Esp., V, 142; Blk., 1860, Cypr., 484, — 1863, Atl., III, 139; Gthr., 1866, Cat., VI, 351.

Heterandria metallica Jor., 1887, P. U. S. Mus., IX, 563.

B. 5; D. 9–10; A. 11–12; V. 6; P. 12–13; Ll. 28–31; Ltr. 8–9; Vert. 15+16.

The shape of this fish does not differ very much from that of *Gambusia Holbrookii*. Body compressed, caudal pedicel deep. Head depressed, crown broad, very little convex, length about one fourth of the distance from snout to base of caudal. Snout short, not as long as eye, broad, blunt. Mouth rather wide; mandibles short, weak, loosely joined; intermaxillaries shorter, protractile. Teeth in a single series, movable, slender, curved, spatulate, narrowed at the bases, broadened toward the summits, varying in shapes from the median to the lateral. In one case, shown in Fig. 6, Plate V., two smaller teeth were found behind the median pair. Eye large, longer than snout, two thirds of forehead, one third of head. Origin of dorsal midway from front of eye to end of caudal, farther back than that of anal. Anal of female with several rays farther forward than dorsal; anal of male farther forward, with third to fifth rays elongate and modified, one third of the total length of the fish. Caudal large, nearly as long as the head, subtruncate or convex; other fins small.

Light yellowish to brownish olive, back and top of head darker, edges of scales little darker, or centres of scales lighter and one or two rows silvery along the middle of the flank. Uniform or with narrow vertical bars of silvery on the sides. In cases the interspaces are brownish, in others there are scattered silvery scales. Belly yellowish to white, with a metallic lustre. Cheeks silvery. Dorsal with a large black spot on the hindmost rays, near the base. Some have a band from this spot across the fin. A few have indications of a darker band across the bases of the caudal rays. Particular females have black spots on the abdomen, as in Gambusia. Occasionally males are found on which the lower border of the anal is black; on certain

specimens the black, broadening forward, extends from the tip of the anal to the chin. Females three and one fourth, and males one and three fourths inches.

Cuba.

Girardinus denticulatus sp. n.

B. 5; D. 9; A. 11; V. 6; P. 12; Ll. 29; Ltr. 9; Vert. 13+17.

This form is closely allied to *G. metallicus;* it is distinguished by the presence of bands of denticles behind the outer series of teeth on the jaws and by the coloration.

Light yellowish or olivaceous brown, edges of scales darker, cheeks, throat, and belly silvery. A band of silvery more or less distinct from the upper angle of the opercle to the middle of the base of the tail. Above this band the back is darker; below it the flanks are light or silvery. None of the specimens show the vertical silvery bars so characteristic of *G. metallicus.* On most a clouded blotch crosses the greater part of the dorsal, becoming more intense backward. A similar blotch, but less vivid is sometimes seen on the anal. Rarely a dark line extends from the occiput to the dorsal. Top of head dark.

Remedios, Cuba.

Girardinus creolus sp. n.

Plate V. Fig 9, teeth.

B. 5; D. 10; A. 11; V. 6; P. 16; Ll. 30–29; Ltr. 9; Vert. 14+16.

Body rather stout, compressed behind the head, caudal pedicel moderately deep. Head broad, as wide as deep, one fourth of the length to the base of the caudal, about equal to depth of body at dorsal origin, flattened on the crown. Snout short, not as long as the eye, broad, truncate. Mouth wide, directed upward, shaped as in Pœcilia; mandibles short, loosely joined; intermaxillaries shorter, protractile. Lips thick. Outer series of teeth larger, broad and hooked toward the apex, constricted toward the base, movable; inner series in bands, small, pointed, slightly broadened toward the point; pharyngeal small, slender, some with a shoulder. Eye large, nearly one third of the head or half of the forehead. Dorsal origin about midway from base of pectoral to base of caudal, above the middle of the anal. Anal of the female not reaching as far backward as the dorsal; fin farther forward on the male, behind the ventrals, equal one third of the total length, modified to form an intromittent organ with a clasper at the end. Ventrals small, reaching the origin of the anal. Pectorals reaching the bases of the ventrals

on the female, or the base of the anal on the male. Caudal deep, as long as the head, slightly convex. Scales large. Intestine long.

Olivaceous to brownish; back, top of head, and edges of scales darker; belly lighter to silvery; cheeks silvery toward the throat. A blotch of dark on the hindmost anal rays in both sexes. A transverse band of brown or brownish near the base of the dorsal, sometimes absent, or lost on very dark fins. Anal of male with lower edge blackish. In cases a light band across the dorsal separates two dark ones. Caudal and other fins clouded, apparently tipped with light color. Some individuals are very dark. The young have faint bars or vertical blotches on the flanks. Females of two and three quarters, and males of one and three quarters inches.

Cuba.

PLATYPŒCILUS.

Platypœcilus Gth., 1866, Cat., VI, 350.

"Cleft of the mouth small, transverse, mandible very short, with the bones not united, the dentary being movable. Snout not produced. Both jaws with a single series of small, pointed teeth. Scales rather large. Origin of the anal fin behind that of the dorsal. Sexes differentiated? Intestinal tract with numerous convolutions. Mud eating. Central America. Although we know only the female of this fish we conclude, from its close affinity to *Pœcilia* and *Mollienisia*, that the anal fin of the male is similarly modified."

Platypœcilus maculatus.

Platypœcilus maculatus Gth., 1866, Cat., VI, 350; Eig., 1893, P. U. S. Mus., XVI, 57.
Platypœcilus mentalis Gill, 1876, P. Phil. Ac., 335.

D. 10; A. 9; V. 6; Ll. 25; Ltr. 8.

"Body much compressed and elevated, its greatest depth being below the origin of the dorsal fin, and contained twice and one third in the total (without caudal). Head less compressed than the body, the width of the interorbital space being nearly two thirds of the length of the head, which is two sevenths of the total (without caudal). The diameter of the eye is more than the length of the snout, and one third of the length of the head. The dorsal fin is rather large, longer than high, and its origin is a little nearer to the root of the caudal than to the extremity of the snout. Anal small, its origin being opposite to the middle of the dorsal. Caudal rounded; the free por-

tion of the tail is short and high, its least depth being equal to the length of the head or to the distance between dorsal and caudal. The pectoral extends considerably beyond the root of the ventral, and the ventral reaches the origin of the anal.

"Brownish olive, with a roundish black spot on the middle of the root of the caudal; a blackish spot on the middle of the side of the trunk. Dorsal sometimes densely spotted with black; the lower margin of the anal and the upper and lower margins of the caudal black."

Mexico. (Günther).

We have given above the original descriptions of genus and species. The specimens, two in number, were an inch and a half in length. Until more data are secured it will not be possible to determine the proper classification or affinities.

MOLLIENISIA.

Mollienisia Les., 1821, J. Phil. Ac., II, 3; Val., 1846, C.V. Poiss., XVIII, 137; Blk., 1860, Cypr., 482, 485, — 1863, Atl., III, 139. *Molienesia* Wagn., 1828, Isis, XXI, 1055. *Molinesia* Cuv., 1836, R. An., ed. 3, I, 533; Schinz, 1836, Nat. u. Abb., 217; Swains., 1839, Class., II, 190, 311; McCl., 1839, J. As. Res., XIX (2), 424; DeK., 1842, N. Y. Fish, 221; Poey, 1855, Mem., I, 382. *Molinisea* Swains., 1838, Class., I, 365. *Mollinesia* Stor., 1846, Syn., 182, — Mem. Am. Ac., II, 434; Ag., 1853, Am. Jour. Sci., XVI, 135; Jor. & C., 1877, B. Buf. Soc., III, 143. *Mollienesia* Ag., 1855, Am. Jour., XIX, 136; Gth., 1866, Cat., VI, 347, — 1880, Intr., 617; Jor. & G., 1882, B. 16 U. S. Mus., 346.

Body short, much compressed, caudal pedicel deep; head depressed crown flattened. Snout short, broad; chin short, steep. Mouth wide, opening upward; lower jaws short, weak, loosely joined; upper shorter, protractile. An outer series of slender, oar-shaped, hooked, movable teeth on each jaw, and behind these a band of small, pointed ones. Dorsal large, larger than anal, subject to considerable changes in males. Anal opposed to the dorsal, but usually originating farther back, modified in the male, as in Pœcilia, to form a short intromittent organ. Caudal region deep and narrow. Scales large, broad. Intestine long. Type *M. latipinna.*

Virginia to Central America.

This genus is closely allied to Pœcilia, with which it agrees in general form, dentition, structure of mouth, and modification of the anal fin. The principal characters on which to base a separation of these genera are the greater size of the dorsal and the greater changes effected by growth in Mollienisia.

Mollienisia latipinna.

Plate V. Fig. 1, teeth; Plate VIII. Fig. 12, male; Plate XII.

Mollienisia latipinna Les., 1821, J. Phil. Ac., II, p. 3, pl. 3; Wagn., 1828, Isis, XXI, 1056; Rich., 1837, R. Brit. Assoc., 213; Val., 1840, R. An., ed. ill., Poiss., p. 229, pl. 95, fig. 4, — 1846, C. V. Poiss., XVIII, 139, pl. 527; Stor., 1846, Syn., 182, — Mem. Am. Ac., II, 434; Blk., 1860, Cypr., 485, — 1863, Atl., III, 140; Gth., 1866, Cat., VI, 348; Jor. & C., 1877, B. Buf. Soc., III, 143; Jor., 1878, B. U. S. G. Sur., IV, 411, 434, — 1881, P. U. S. Mus., III, 22, — 1885, P. U. S. Mus., VII, 320, 323, — 1887, R. U. S. F. Com., 838; Goode, 1880, P. U. S. Mus., II, 119; G. & B., 1880, P. U. S. Mus., II, 151, 342, — 1883, P. U. S. Mus., V, 239; Jor. & G., 1882, B. 16, U. S. Mus., 347, 894, — 1883, P. U. S. Mus., V, 258; Jor. & M., 1885, P. U. S. Mus., VII, 235; Gilb., 1890, B. U. S. F. Com., VIII, 228; Hensh., 1891, B. U. S. F. Com., IX, 374; Everm., 1892, B. U. S. F. Com., X, 88; Woolm., 1892, B. U. S. F. Com., X, 296, 300.

Pœcilia latipinna Put., 1863, B. M. C. Z., 13.

Pœcilia multilineata Les., 1821, J. Phil. Ac., II, p. 4, pl. 1; Wagn., 1828, Isis, XXI, 1055, Rich., 1837, R. Brit. Assoc., 213; Val., 1846, C. V. Poiss., XVIII, 134; Stor., 1846, Syn., 178, — Mem. Am. Ac., II, 430.

Pœcilia lineolata Grd., 1859, P. Phil. Ac., 114, — Mex. Bd. Sur., Fish, 70, pl. 35, fig. 9–11.

Mollinesia lineolata Jor. & C., 1877, B. Buf. Soc., III, 143; Jor., 1878, B. U. S. G. Sur., IV, 434; Jor. & G., 1882, B. 16, U. S. Mus., 894, — 1883, P. U. S. Mus., V, 259; G. & B., 1883, P. U. S. Mus., V, 239.

Gambusia lineolata Blk., 1860, Cypr., 485.

Limia pœciloides Grd., 1859, P. Phil. Ac., 115, — Mex. Bd. Sur., Fish, 70, pl. 38, fig. 8–11.

Gambusia pœcilioides, Blk., 1860, Cypr., 485.

Mollinesia pœcilioides Jor. & C., 1877, B. Buf. Soc., III, 143; Jor., 1878, B. U. S. G. Sur., IV, 434.

Limia formosa Grd., 1859, P. Phil. Ac., 115.

Mollienesia formosa Gth., 1866, Cat., VI, 349; Jor. & C., 1877, B. Buf. Soc., III, 143; Jor., 1878, B. U. S. G. Sur., IV, 434; Jor. & G., 1882, B, 16 U. S. Mus., 347; Eig., 1893, P. U. S. Mus., XVI, 57.

Limia matamorensis Grd., 1859, P. Phil. Ac., 116.

Gambusia matamorensis Blk., 1860, Cypr., 485.

Mollienesia matamorensis Jor. & C., 1877, B. Buf. Soc., III, 143; Jor., 1878, B. U. S. G. Sur., IV, 434.

B. 5; D. 14–16; A. 10–9; V. 6; P. 14–15; Ll. 27–30; Ltr. 9; Vert. 15+15 to 14+14.

In the superior aspect the body is much compressed and tapers from the head to the caudal; seen from the side body and tail are very deep and the head is short wedge-shaped. Head flattened on the crown, less than depth of body, nearly one fourth of the length to the base of the caudal. Snout broad, short, as long as the eye, or shorter in young, truncate; chin steep. Mouth wide, directed upward, lower jaws longer, loosely joined; upper shorter, protractile. Teeth in the outer series slender, movable, narrow at the base, widened or oar-shaped and hooked near the crown; inner in bands, very small, pointed, hooked. Eye of moderate size, as long as snout or longer, half of forehead, about two sevenths of the head. Dorsal longer than anal, becoming elongate and high in the males, first ray near the middle of the body length in young but nearer the head in old. Anal small, origin farther back than that of dorsal, intromittent portion on the male shorter than the head and similar to that of Pœcilia, advanced between the

ventrals on males. Ventrals small, second ray elongate in the male. Pectorals moderate, reaching a vertical from the bases of the ventrals on females or behind the anal on males. Caudal deep, median rays longer. Scales large, broad, short. Intestine long.

Olivaceous to greenish or yellowish, silvery to white below. Commonly each scale on flanks and back is marked with a dark spot on its middle; these spots are more or less confluent into lines. Variations in maculation and in the markings of the fins are shown on Plate XII. In life the males are likely to be tinted with bluish and yellow. Frequently the sides of the head, the middle of the caudal, and the edge of the dorsal are yellow. Rarely upper and lower edges of the caudal are black. Many have vertical bands on the flanks. Occasional specimens are blotched with black somewhat as appears in the figures of *Gambusia Holbrookii*, Plate XI. Fig. 4 and 5. The larger, more elongate spots on the dorsal of the male are usually edged with bright color. The ground color of the fin varies from bluish to yellow. Figure 9 of Plate XII. represents a male at the period of greatest sexual variation in shapes and markings. The largest individual of this sex at hand measures three and seven eighths inches.

Virginia to Mexico.

Mollienisia petenensis.

Mollienesia petenensis Gth., 1866, Cat., VI, 348, —1868, Tr. Zool. Soc. Lond., VI, 485, pl. 86, fig. 1–3; Eig., 1893, P. U. S. Mus., XVI, 57.

B. 6; D. 15; A. 8–9; Ll. 30; Ltr. 10; Vert. 30.

Height one third, and length of head one fourth or two ninths of the length to the base of the caudal. Eye equal length of snout, two sevenths of head, rather less than half of interorbital space. Length of dorsal in male equals half the distance from eye to root of caudal, in female two fifths. Caudal rounded, base scaly; pedicel as deep as long, with nine series of scales along each side. Lateral line indistinct.

Greenish or brownish green, silvery below. A dark spot to each scale of the upper and middle caudal series and the lower part of the trunk. Dorsal fin of adult male with small irregular brown lines or spots, and with a row of large rounded spots along the middle of its height. Interradial membrane of caudal with numerous black dots; lower part of margin black. Dorsal on females and immature males simply ornamented with small irregularly curved brown spots.

Lake Peten. (Günther.)

The figures of this species show the caudal on females to be nearly or quite truncate, while on the male it is indented in the lower half and the lower edge is produced in a sharp angle that bears a remote resemblance to the prolongation on the male of Xiphophorus. The transformations of dorsal and ventrals due to age and sex in this species are similar to those obtaining on *M. latipinna*.

Mollienisia Jonesii.

Mollienesia Jonesii Gthr., 1874, Ann. Mag. Nat. Hist., (4), XIV, 371; Jor. & G., 1882, B. 16 U. S. Mus., 347; Eig., 1893, P. U. S. Mus., XVI, 57.

"D. 12; A. 10; Ll. 29; Ltr. 9.

"*Female.* The height of the body is two sevenths or one fourth of the total length (without caudal), the length of the head one fourth. The diameter of the eye is rather shorter than the snout, one fourth of the length of the head, and one half of the width of the interorbital space. The length of the dorsal fin is one fourth of the distance between the eye and the root of the caudal; it is much longer than high. Anal fin small, opposite to the middle of the dorsal. Lateral line none. Brownish, each scale with a deep-black hind margin; a black band between the eye and scapula; a round black spot on the upper half of the root of the caudal. Dorsal fin with two or three series of black spots; anal with a black line behind and along each ray; the other fins immaculate.

"This species was discovered by T. M. Rymer Jones, Esq., in a volcanic lake, Alcohuaca, near Huamantla, in Mexico, 8000 feet above the level of the sea. Several specimens were presented by him to the British Museum; all are females; and the largest exceeds somewhat the length of 3 inches."

PŒCILIA.

Pœcilia Bl. Schn., 1801, Syst., pp. lii, 452; Cuv., 1817, R. An., II, 198, — 1829, R. An., II, 280, — 1836, R. An., I, 532; Ansl., 1828, Syst. Besch., IV, 319; Val., 1828, Humb. Obs., II, 156, — 1846, C. V. Poiss., XVIII, 112, — 1840, R. An., ed. ill., Poiss., 227; Wagn., 1828, Isis, XXI, 1054; Schinz, 1836, Abb. Fische, 216; Poey, 1855, Mem., I, 381; Blk., 1860, Cypr., 483, 485; Gth., 1866, Cat., VI, 339 — 1880, Intr., 317; Jor., 1887, P. U. S. Mus., IX, 564.

Gambusia Blk., 1860, Cypr., 485.

Heterandria Jor., 1887, P. U. S. Mus., IX, 563.

In each of the foregoing, species belonging to other genera were included. The following mention only species here retained in the genus.

Pœcilia Flem., 1822, Phil. Zool., II, 386; M. & Tr., 1848, Schomb. Guiana, III, 632; Blk., 1863, Atl., III, 140; Kner, 1867, Novara Fische, 345.

Limia Poey, 1855, Mem., I, 383, 390, — 1861, Mem., II, 383, — 1868, Repert., II, 209, 411, — 1876, An. Soc. Esp., V, 141.

Lebistes Filippi, 1861, Arch. per la Zool., Canestr., I, 69.

Body short, much compressed; caudal pedicel deep; head depressed, crown flattened. Snout short, broad, blunt; chin steep. Mouth wide, opening upward; lower jaws short, weak, loosely joined; upper shorter than lower, protractile. An outer series of slender, spatuliform, or oar-shaped, hooked, movable teeth on each jaw, and behind these a band of very small one to three cusped teeth. Branchiostegal rays five. Dorsal and ventrals small. Dorsal origin behind the middle of the body, excluding the caudal. Caudal deep, convex on hind margin. Anal opposed to the dorsal or farther forward, modified in the male to form a short intromittent organ, about as long as the head. Scales large. Intestine long, much convoluted. Type *Pœcilia vivipara* Bl. Schn., *P. Schneideri* Val.

West Indies; Mexico; Central America to Brazil.

Pœcilia vivipara.

Plate V. Fig. 4,7, teeth; Plate VIII. Fig 11, male.

Pœcilia vivipara Bl. Schn., 1801, Syst., pp. lii, 452, pl. 86, f. 2; Goldf., 1820, Handbuch, II, 16; Flem., 1822, Phil. Zool., II, 386; M. & Tr., 1848, Schomb. Guiana, III, 632; Blk., 1860, Cypr., 486, — 1863, Atl., III, 140; Pet., 1864, Mb. Brl. Ak., 395; Gth., 1866, Cat., VI, 344; Jor., 1887, P. U. S. Mus., IX, 564; Eig., 1891, P. U. S. Mus., XIV, 65.

Pœcilia Schneideri Val., 1828, Humb. Obs., II, 159, — 1846, C. V. Poiss., XVIII, 135; Wagn., 1828, Isis, XXI, 1054; Rich., 1837, R. Brit. Assoc., 213; Blk., 1860, Cypr., 486.

Pœcilia surinamensis Val., 1828, Humb. Obs., II, 158, pl. 51, f. 1, — 1840, R. An., ed. ill., Poiss., 227, pl. 95, f. 1, — 1846, C. V. Poiss., XVIII, 120; Wagn., 1828, Isis, XXI, 1054; Duv., 1844, Ann. Sc. Nat., I (3), 313; Pet., 1864, Mb. Brl. Ak., 396; Eig., 1891, P. U. S. Mus., XIV, 65.

Pœcilia unimaculata Val., 1828, Humb. Obs., II, 158, pl. 51, f. 2, 5, 6, — 1846, C. V. Poiss., XVIII, 128; Wagn., 1828, Isis, XXI, 1054; Jen., 1842, Beagle Zool. Fish, 114; Gth., 1866, Cat., VI, 346; Kner, 1867, Novara Fische, 345; Hens., 1868, Arch. f. Naturg., XXXIV, 358, — 1869, Arch. Nat., XXXV, 89; Mart., 1876, Preuss. Exp. Zool., I, 37, 401; Steind., 1881, Denk. Ak. Wien, XLIV, extr. p. 9; Eig., 1881, P. U. S. Mus., XIV, 65.

Pœcilia unipunctata Guër., 1838, Icon. Poiss., 28, pl. 47, f. 3.

Molinesia surinamensis Pet., 1844, Bericht Brl. Ak., 36; Blk., 1860, Cypr., 485.

Pœcilia unimacula Blk., 1860, Cypr., 486.

Girardinus versicolor Gth., 1866, Cat., VI, 352.

Heterandria versicolor Jor., 1887, P. U. S. Mus., IX, 563.

Pœcilia vivipera parœ Eig., 1894, Ann. N. Y. Ac., VII, 629.

B. 5; D. 8–9; A. 9–10; V. 6; P. 14–15; Ll. 26–28; Ltr. 8; Vert. 14+14.

Body stout, short, thick, flattened above the shoulders, deep and narrow in the caudal section. Head short, one fourth of the length to the base of the caudal, much less than the height of the body, as broad as deep, flat on the crown. Snout broad, short, length half of the width of the forehead, nearly as long as the orbit, subtruncate; chin moderately steep. Mouth wide, one and one half times the eye, directed upward; jaws weak, loosely

joined, lower longer, upper short, protractile. Teeth in the outer series slender, narrowed at the base, broadened or spatuliform toward the apex, hooked, movable; in the inner series very small, one cusped, subtricuspid or slightly broadened toward the apex; in the pharyngeal groups, slender, pointed, arranged in short rows. Eye medium, little longer than snout, little more than a fourth of the head or half of the forehead. Fins small, excepting caudal. Dorsal origin about midway from snout to end of caudal, slightly in front of that of anal, thirteen scales behind the occiput. Pectorals reaching a vertical from behind the bases of the ventrals. On males the anal is farther forward, a vertical from the first ray being reached by the pectorals. The anal process in this sex is comparatively short, about three fourths as long as the head; it has an elongate fleshy lobe beneath its apex, and extends but little farther back than the long slender second rays of the ventrals. Caudal deep as long, hardly as long as the head, median rays little longer. Scales large. Intestine more than twice as long as the fish.

Brownish to olivaceous or yellowish, darker on the vertebral line and top of the head, the latter with a central streak or spot of light color. Darker on the posterior half of each of the majority of the scales, or with darker edges to the scales, or nearly uniform yellowish. In most cases, with three to seven vertical bands of brownish, as wide as the interspaces, on the flank, behind the middle of the abdominal cavity, and with a blackish spot on the eighth and ninth scales behind the angle of the operculum, on the second series below the origin of the dorsal and but two to three scales distant from it. This spot on many is edged with white. Some are freckled with silvery scales, or have the spaces on the flank of that color. A black spot on the middle of the posterior rays of the dorsal, in cases with a band to the front edge. Dorsal frequently, and sometimes anal and pectorals, tipped with black. Caudal with three or more vertical bands of puncticulations or small spots, or simply clouded, or uniform. Rarely dorsal and caudal are irregularly sprinkled with black spots. A dash of black on each edge of the base of the caudal is common.

Reaches a length of three and a half inches.

Rio Janeiro to Martinique.

Fewer of the adults from Martinique and Crab Island bear the spot on the eighth and ninth scales of the lateral line, in comparison with southern specimens, and on the young it is rather less distinct; but on the other hand the black spots at each edge of the caudal base are larger, and the several

indications of transverse bands on the caudal are a little more distinct. Before modified by use the small teeth in the bands on the jaws appear to be subtricuspid. The lateral cusps, being less robust than the central, do not persist, as in *P. vittata*, but in the wearing process assume irregular shapes as in Plate V. Fig. 4, or finally such as are shown in Fig. 7 of the same plate. The description of the pharyngeal teeth by Duvernoy is given below; whether they are equally movable in adults may be determined better from fresh specimens.

"B. 6; D. 7; A. 7; V. 6; P. 12; C. 20.

"P. corpore compresso, capite squamato, supra depresso, lato, ore angusto, linea laterali dorso vicina, pinna caudae lata, bifida, ano capiti viciniore.

"Corpus breve, caput trunco angustius, nudum, obtusum, argenteum, opercula lævia, nares simplices ante oculos, apertura branchialis labium superius angustius, dentium setaceorum series unica ampla, venter ab embryonibus turgidus, pinnæ obtusæ, radiatæ, squamæ rotundatæ, integræ.

"Habitat in aquis dulcibus Surinami bipollicaris."

The above is the original description of Bloch and Schneider. Under *Pœcilia Schneideri* Valenciennes has the following: —

"Est-ce bien une pœcilie que le poisson décrit et figuré par Bloch dans l'édition de Schneider sous le nom de *Pœcilia vivipara ?* Je n'en suis pas certain; mais ne sachant où le placer mieux, je le maintiens provisoirement à la suite du genre. Il a le corps comprimé; la tête couverte d'écailles, plate et large en dessus; la bouche étroite; une rangée de dents petites et fines comme des soies; la caudale est fourchue. B. 6; D. 7; A. 7; V. 6; P. 12; C. 20. Le nombre des rayons branchiostèges et même ceux de la dorsale et de l'anale ne sont pas de nos pœcilies. Bloch le colore de jaunâtre, avec cinq larges bandes transversales brunes. C'est un poisson long de deux pouces, qui vit dans les eaux douces de Surinam."

The peculiar coloration and the forked tail given this species by Bloch in his description and figure would have made it unrecognizable without the aid of his type. Happily this was preserved in the Berlin Museum. In 1864 Peters examined it carefully, compared it with the original figure, and published the following remarks: —

"Ich bemerke hierbei, dass das Originalexemplar von Bloch (No. 3465 unserer Sammlung) ganz vortrefflich zu der Abbildung (Systema Ichthyol. Taf. 86) passt, welche das Thier von der Bauchseite gesehen darstellt, indem es dieselbe Grösse hat und auch der mit Jungen angefüllte Bauch noch in derselben Weise klafft; auf dem Boden des Glases liegen Junge in verschiedener Entwickelung, die eben da abgebildet

sind. Das Exemplar ist schon sehr verblichen, sieht aber bräunlich aus und hat an manchen Stellen die Schuppen verloren, wodurch es ein schwach gebändertes Ansehen erhält. Ferner ist die Schwanzflosse etwas verletzt und längs der Mitte aufgerissen. Hierdurch erklärt sich die allerdings zum Theil ganz unrichtige Seitenansicht des Fisches mit regelmässigen Querbinden und gabeliger Schwanzflosse, welche letztere in der That abgerundet ist, wie bei *P. surinamensis* Val., mit der er mir vollständig übereinzustimmen scheint."

The formula for *P. surinamensis* Val. is B. 5; D. 7; A. 7; V. 6; P. 13; C. 24. Six branchiostegal rays instead of five is within the range of individual variation. In species having six as the usual number there are individuals with only five on one side or on both sides, and some with the fifth ray divided or forked, as if two rays had grown together at their bases. Neither Bloch nor Peters describes the dentition of *P. vivipara*. Duvernoy, 1844, Ann. Sc. Nat., I (3), 355, writes of the teeth of *P. surinamensis* as follows: —

"Les dents inter-maxillaires et mandibulaires forment d'abord une simple rangée extérieure, de figure un peu conique, recourbée vers la pointe, et de grandeur un peu inégale. Il y a, de plus, en dedans, un pavé de ces mêmes dents, mais plus petites, qui sont séparées de la rangée externe par une bande nue, fort étroite à la vérité. Ces dents en pavé ont une couronne plus courte, émoussée ou obtuse à la pointe. Les dents pharyngiennes sont implantées, par leur racine, en haut et en bas, dans une double plaque, de substance élastique subcartilagineuse, jaunâtre et demi-transparente. Les plaques pharyngiennes supérieures sont ovales, un peu plus étroites en avant qu'en arrière. Les dents y sont disposées par rangées transversales, et séparées, dans ces rangées, par groupes de cinq, six, sept ou huit. Ces groupes ne sont en séries transversales que dans le tiers, ou tout au plus la moitié postérieure. Ils sont disposés irrégulièrement dans le reste de la surface. Les plaques pharyngiennes inférieures sont de même nature. La forme des deux plaques réunies est celle d'un cone dont la pointe serait en avant. Les dents y sont disposées, dans toute l'étendue de ces plaques, par lignes transversales et parallèles à des intervalles à peu près égaux. Toute la partie libre ou la couronne de la dent peut s'incliner et se mouvoir, en arrière ou en avant, si on emploie un corps resistant; elle se relève aussitot que la résistance a cessé. Il y a une articulation à ressort, précisément à la jonction de la racine et de la couronne où cette flexion a lieu. Celle-ci est grêle, longue, en forme de fuseau, colorée en gris ou en brun dans le dernier tiers de sa longueur, incolore dans le reste de son étendue. Sa racine est presque aussi longue et bifurquée à son extrémité. Beaucoup de ces dents ont une légère courbure; dans quelques unes, elle est assez prononcée, ce qui donne un peu à la couronne la forme d'une alêne."

This description applies fairly well to the teeth of our specimens of *P. unimaculata.* The greatest deviation appears in the outer series on the jaws, which teeth are not conical in adults (Plate V. Fig. 7), though in very young ones there is sufficient approach to that shape to justify the statements made.

Peters, 1864, suggested the identity of vivipara and surinamensis. Gthr., 1866, united them. Steindacher, 1881, after examining specimens of unimaculata from Rio Janeiro, Parahyba, Surinam, and Cayenne, remarks: "Vielleicht ist *P. surinamensis* Val. von *P. unimaculata* Val. der Art nach nicht verschieden." Numerous representatives, from Rio Janeiro, Porto Seguro, Bahia, Pernambuco, Parahyba, a number of points on the Amazon, and from British Guiana, make it reasonably certain that Valenciennes species are identical. The figure given by Bloch and Schneider is quite misleading. Peters in his study of the type found the fork in the tail to be due to accidental mutilation, and the bands he traced to loss of scales. As shown in the description many individuals are yellowish, hardly so bright as the figure, and transverse bands, not distributed quite as in the figure, are of the commonest marks in the specimens of *unimaculata* Val. The figures in the formula originally given for vivipara, are, excepting the number of ventral rays, generally conceded to represent variations of one or two each from the actual averages.

Pœcilia dominicensis.

Plate IV. Fig. 12, teeth.

Pœcilia dominicensis Val., 1846, C. V. Poiss., XVIII, 131, pl. 526, fig. 1; Blk., 1860, Cypr., 486; Gth., 1866, Cat., VI, 346; Jor., 1887, P. U. S. Mus., IX, 564.

Pœcilia melanogaster Gth., 1866, Cat., VI, 345; Jor., 1887, P. U. S. Mus., IX, 564.

Pœcilia (*Acropœcilia*) *tridens* Hilg., 1889, Sb. Ges. Nat. Fr., 52.

B. 5–6; D. 9-8; A. 10–9; V. 6; P. 15; Ll. 26–28; Ltr. 8; Vert. 14 + 15.

Body rather short and stout, compressed, caudal pedicel deep; depressed on nape and head. Head broad, flattened on the crown, two sevenths of the length to the base of the caudal, less than depth of body. Snout short, about half the length of the orbit, subtruncate; chin short, steep. Mouth as wide as the eye, opening upward; lower jaws weak, loosely joined, longer than upper; upper shorter, protractile. Teeth in outer series slender, narrow at the bases, broadened toward the apices, hooked; inner teeth small, in a viliform band, tricuspid; pharyngeal slender, hooked, with a shoulder, arranged

in short groups in transverse series, as in *P. vivipara*. Eyes large, more than one third of the head, nearly twice the snout, two thirds of forehead. Branchiostegal rays five, the fifth frequently split to the base as if formed by the union of two. Fins small, excepting caudal. Dorsal origin slightly behind the middle of the total length, in the female ; anal origin several rays farther forward. On males the anal is still farther forward, between the ventrals, and is modified to form an intromittent organ as long as the head. The dorsal also is advanced in this sex and the second ray of each ventral extends back at the side of the anal process. Pectorals small in females, reaching a vertical from the base of the ventral ; longer in males and reaching behind a vertical from the origin of the anal. Caudal about as long as the head, median rays longer. Scales large. Intestine long.

Olivaceous, dark on back, lighter on flanks, silvery below. Sides more or less iridescent. Cheeks silvery. Scales with darker edges. Faintly darker from eye to middle of caudal. Top of head dark, with a small spot of lighter in the middle. Along the middle of the flank some have series of scales marked in the anterior portion by silvery and on the hinder half of each scale by brown. Commonly with a black spot on the middle of the posterior rays of the dorsal. Vertical narrow bars of silvery and brownish are more common on the males. Dorsal and anal in cases edged with blackish. Caudal with faint transverse cloudings or bands, or plain. A vertebral line and blackish mottling on the edges of the caudal base are sometimes present.

Hayti ; San Domingo.

Pœcilia vittata.

Plate IV. Fig. 11, teeth ; Plate VIII. fig. 10, male.

Pœcilia vittata Guich., 1855, Poiss. Cuba, 224, pl. V, fig. 1 ; Gth., 1866, Cat., VI, 339 ; Jor., 1887, P. U. S. Mus., IX, 564.

Limia vittata Poey, 1855, Mem., I, 389, 391, 463, pl. 31, fig. 14–16, — 1861, Mem., II, 383, — 1868, Repert., II, 169, 411, — 1876, An. Soc. Esp., V, 141.

Gambusia vittata Blk., 1860, Cypr., 485.

Limia cubensis Poey, 1855, Mem., I, 388, 391, pl. 31, fig. 12–13, pl. 32, fig. 10–11, — 1861, Mem., II, 383, — 1868, Repert., II, 411, — 1876, An. Soc. Esp., V, 141, — 1880, An. Soc. Esp., IX, 247.

Gambusia cubensis Blk., 1860, Cypr., 485.

Pœcilia cubensis Gth., 1866, Cat., VI, 340.

Limia pavonina Poey, 1876, An. Soc. Esp., V, 142.

Pœcilia pavonina Jor., 1887, P. U. S. Mus., IX, 564.

B. 6 ; D. 10 (rarely 9) ; V. 6 ; P. 14–15 ; Ll. 27–30 ; Ltr. 9 ; Vert. 15 + 14.

Body stout and thick, compressed, deep in the caudal region. Head short and thick, nearly as wide as high, about two ninths of the length to the

base of the caudal. Snout broad, subtruncate, nearly or quite as long as the eye. Mouth moderately wide, directed upward; lower jaws longer, loosely joined; upper shorter, protractile. Outer series of teeth slender, movable, narrowed toward the base, widened toward the apex, hooked; inner in bands, small, tricuspid. Eye large, about as long as snout or longer in young, half of interorbital space, two sevenths of head. Fins medium, excepting caudal, which is large. Dorsal origin little behind the middle of the length, without the caudal. Anal origin a short distance behind that of dorsal in females; fin advanced and modified in males, process shorter than head and bearing a short fleshy lobe below its extremity. The first ray of the dorsal is a trifle farther forward in the male, and the fin is higher and broader. Ventrals small, second ray elongate in males. Caudal deep, nearly as long as head, truncate. Scales large. Intestine long.

Olivaceous, darker on back and top of head, lighter to silvery downward on the flanks and beneath, edges of scales darker. Cheeks silvery. With or without vittæ, formed by a spot on each scale of one to several series, on the middle of the flank. Without or with vertical narrow bars of brownish on the sides, a longitudinal silvery streak, or a brownish tint along the middle of the flank. Fins plain to puncticulate or spotted with black, or dorsal and caudal with one to several irregular transverse series of spots. In the breeding season the dorsal of the male becomes longer; in cases it reaches the short rays of the caudal and the fin is blotched with black and yellow. Some individuals have large irregular blotches of black scattered over the sides. Largest female four and one fourth and largest male two and one eighth inches. Cuba.

Pœcilia sphenops.

Plate IV. Fig. 13, teeth.

Pœcilia sphenops Val., 1846, C. V. Poiss., XVIII, 130, pl. 526; Blk., 1860, Cypr., 486; Gth., 1866, Cat., VI, 343; Eig., 1893, P. U. S. Mus., XVI, 57.

Limia couchiana Grd., 1859, P. Phil. Ac., 116.

Gambusia couchiana Blk., 1860, Cypr., 485.

Pœcilia couchii Gth., 1866, Cat., VI, 347; Eig., 1893, P. U. S. Mus., XVI, 57.

Mollinesia couchiana Jor. & C., 1877, B. Buf. Soc., III, 142; Jor., 1878, B. U. S. G. Sur., IV, 434.

Pœcilia couchiana Jor., 1887, R. U. S. F. Com., 838; Everm. & K., 1894, B. U. S. F. Com., pp. 76, 84, 87, 89, 92, 108.

Pœcilia mexicana Steind., 1863, Sb. Ak. Wien, XLVIII, 178, pl. IV., fig. 1, 1 a; Gth., 1866, Cat., VI, 340; Trosch., 1865, Syst. Wirb. Mex., 104; Eig., 1893, P. U. S. Mus., XVI, 57.

Pœcilia thermalis Steind., 1863, Sb. Ak. Wien, XLVIII, 181, pl. 4, fig. 3, 3 a; Trosch., 1865, Wirb. Mex., 104; Gth., 1866, Cat., VI, 341; Eig., 1893, P. U. S. Mus., XVI, 57.

Gambusia modesta Trosch., 1865, Wirb. Mex., 105.

Gambusia plumbea Trosch., 1865, Wirb. Mex., 106.

Pœcilia petenensis Gth., 1866, Cat., VI, 342, — 1868, Tr. Zool. Soc. Lond., VI, 484, pl. 85, fig. 3, 4; Eig., 1893, P. U. S. Mus., XVI, 57.

Pœcilia dovii Gth., 1866, Cat., VI, 344; Gill, 1877, P. Phil. Ac., 187; Eig., 1893, P. U. S. Mus., XVI, 57.

Pœcilia spilurus Gth., 1866, Cat., VI, 345; Eig., 1893, P. U. S. Mus., XVI, 57.

Pœcilia Butleri Jor., 1889, P. U. S. Mus., XI, 330; Eig., 1893, P. U. S. Mus., XVI, 57.

(*Mollinesia fasciata* Pet., 1844, Ber. Ak. Wiss. Berl., 36; Blk. 1860, Cypr., 485; *Pœcilia fasciata* Eig. 1893, P. U. S. Mus., XVI, 57, may refer to this species. Whether it does can only be decided by the original specimen. "D. 8; A. 9; mit dunkeln Querbinden; Mexico," is all that was said of it.)

B. 6; D. 10–9; A. 9–10; V. 6; P. 15; Ll. 25–28; Ltr. 9–8; Vert. 14 + 14.

Body not much elongate, greatly compressed, depth of large specimens near one third of the length to the base of the caudal; caudal pedicel deep. Head three and two thirds times in the length of the body without the caudal, not as wide as deep, slightly arched across the crown. Snout moderate, blunt; chin steep. Mouth rather small, directed upward; lower jaws longer, loosely joined; upper short, protractile. Teeth in the outer series slender, movable, broadened and hooked toward the apex; inner teeth in bands, tricuspid. Eye large, longer than the snout, more than half of the interorbital space, four thirteenths of the head. Dorsal larger than anal, first ray about midway from occiput to base of caudal. First ray of anal below second or third of dorsal, base or tip not reaching as far backward as those of the latter. Anal modified on the male, much advanced, between the ventrals, hardly as long as the head. Caudal deep, as long as the head, slightly convex, scaly toward the base. Scales large. Intestine long.

Olivaceous, light or yellowish to dark, edges of scales darker, with or without irregular blotches of black scattered over back and sides; sometimes clouded or blotched with brownish or with faint vertical bands of lighter. Lower half of head and belly silvery to golden. Dorsal usually marked with rather large to very small spots of black, scattered or in transverse series. Caudal plain or marked with spots like the dorsal. Fins commonly darkened toward the tips. Top of head dark. Male with larger fins and more spots than the female. Young with transverse markings which persist on some of the older ones. This species is subject to considerable variation. A larger collection than we now possess is necessary to determine what varieties are included.

Mexico to Central America.

Pœcilia occidentalis.

Plate V, Fig. 5, teeth.

Heterandria occidentalis B. & G., 1854, P. Phil. Ac., VI (1853), 390; Blk., 1860, Cypr., 485; Jor., 1887, R. U. S. F. Com., 838.

Girardinus occidentalis Grd., 1859, P. Phil. Ac., 119, — Mex. Bd. Sur. Fish, 73, pl. 39, fig. 16–19; Blk., 1860, Cypr., 484; Trosch., 1865, Wirb. Mex., 108; Gth., 1866, Cat., VI, 354; Jor. & C., 1877, B. Buf. Soc., III, 142; Jor., 1878, B. U. S. G. Sur., IV, 434; Jor. & G., 1882, B. 16 U. S. Mus., 349; Eig., 1893, P. U. S. Mus., XVI, 58.

Girardinus sonoriensis Grd., 1859, P. Phil. Ac., 120; Blk., 1860, Cypr., 484; Gth., 1866, Cat., VI, 355; Cope & Y., 1875, Wheel. Exp. Zool., V, 695; Jor. & C., 1877; B. Buf. Soc., III, 142; Jor., 1878, B. U. S. G. Sur., IV, 434.

B. 5; D. 8; A. 10–11; V. 6; P. 15; Ll. 27–30; Ltr. 8; Vert. 15+15.

Shaped much like *Gambusia Holbrookii.* Stout anteriorly, compressed backward, depressed on the head. Head broad, slightly arched across the crown, less than the depth of the body, less than one fourth of the length from snout to base of caudal. Snout short, narrowed forward, blunt; chin steep. Mouth narrow, not as wide as the eye; lower jaw longer; upper short, protractile. Teeth in the outer series long, hooked spatuliform, compressed in the basal half, broadened toward the summit; inner series small, pointed, slightly hooked; pharyngeal grouped in short rows. Eye moderate, as long as snout, little more than half of interorbital space, two sevenths of the head. Dorsal small, originating midway from base of pectoral to base of caudal or above the middle of the base of the anal. Caudal as long as the head, median rays longer.

Light yellowish to olivaceous, puncticulate with dark, hind edges of scales darker, opercle silvery, sides of belly golden to silvery, middle of belly and throat silvery. A dark band one scale in width from head to middle of caudal. The middle of the band is traversed by a black line; another line is found behind the anal; and a third behind the dorsal. Anal aperture in a black spot. Fins plain to puncticulate with dark, or with a darkish transverse band near the base of dorsal and anal. On one the dorsal has a distinct spot of black at the bases of the posterior rays. Whether the anal process of the male is short and whether the jaws are loosely joined cannot be decided from these specimens; this leaves us in doubt whether the species may not belong to Glaridodon to which it makes considerable approaches.

San Bernardino Creek, Mex.; Nickson, Arizona.

Pœcilia cuneata, sp. n.

Plate V. Fig. 3, teeth.

B. 5; D. 8–10; A. 10–9; V. 6; P. 15–16; Ll. 28–29; Ltr. 9.

Short and deep; caudal pedicel deep. Head depressed, broad, flat on the crown, equal the depth between dorsal and anal or one fourth of the length to the base of the caudal. Snout as long as the eye, broad, truncate; chin short, steep. Mouth wide, directed upward; jaws weak, loosely joined, lower short, upper shorter, protractile. Outer series of teeth slender, oar-shaped, hooked, movable; inner in bands, small, pointed. Eye large, as long as snout, half of interorbital space, two sevenths of head. Dorsal larger than anal, origin midway from head to base of caudal, over third ray of anal, thirteen scales behind the occiput. Anal small, acute angled, third ray longest. On the male the base of the anal is forward of that of the dorsal, the fin is modified to form a sharp pointed organ in which the rays are less changed than in most species; its length is less than that of the head. Ventrals small, not reaching the anal. Pectorals reaching back over seven scales. Caudal deep, as long as the head, hind margin rounded. Scales large. Intestine long.

Brownish, olive tinted, bases of scales dark, back darker and top of head darkest. More or less of the hind margin, or half of the scale, is whitish to silvery on the scales of the flank. Lighter to silvery under head and abdomen. Dorsal with one to several transverse series of small spots of black; fin sometimes black tipped. A brownish streak extending back and upward on the opercle behind the eye. Caudal with small spots of black on the basal half, or with a couple of clouded transverse bands. Other fins uniform or puncticulate. Very small ones are lighter with a faint silvery band along the middle of the flank but without vertical bars. A large one has numerous small white spots, somewhat like *Fundulus heteroclitus*. Females two and a half and males one and nine tenths inches.

Turbo, Gulf of Darien.

Pœcilia reticulata.

Pœcilia reticulata Pet., 1860, Mb. Brl. Ak., 1859, 412.
Girardinus reticulatus Gth., 1866, Cat., VI, 352; Eig., 1891, P. U. S. Mus., XIV, 65.
Girardinus guppii Gth., 1866, Cat., VI, 353; Eig., 1891, P. U. S. Mus., XIV, 65.
Pœcilia vandepolli Lidth., 1887, Notes Leyd. Mus., IX, 137.
Pœcilia vandepolli var. *arubensis* Lidth., 1887, l. c., 138.
Heterandria guppii Jor., 1887, P. U. S. Mus., IX, 563.
Pœcilia branneri Eig., 1894, Ann. N. Y. Ac., VII, 629.

D. 7–8; A. 8–9; V. 5; Ll. 26–28; Ltr. 8.

Depth of body two sevenths and length of head nearly one fourth of the length to the base of the caudal. Males rather more slender. Eye longer than snout, not quite one third of head, three fifths of interorbital space. Forehead flat. Dorsal origin somewhat nearer to end of snout than to end of caudal, opposite first ray of anal on females. Anal of male advanced, between the ventrals, which are elongate; anal process as long as the head, without hooks. Caudal large, rather longer than the head, obtusely rounded. Free portion of tail somewhat elongate, base of anal being one third of its distance from the caudal. Ventrals reaching the anal. Pectorals as long as the head, not reaching the ventrals.

Female yellowish olive, scales with a narrow blackish edge, belly silvery, trunk above the belly blackish.

Male with two brown streaks along the trunk, sometimes confluent into a band, a brown streak along the middle of the side of the tail, a round black spot behind the shoulder, another at the commencement of the caudal streak, and a third at the root of the caudal. One or two of these spots may be absent.

Trinidad; Venezuela.

The male from Venezuela differs in color from those of Trinidad: it has large silvery patches between the brown streaks and a large ovate black spot in the middle of the side of the tail.

(Günther).

The following is the original description: "Grüngelblich mit einem schwarzen Netzwerk, dessen Maschen den Rändern der Schuppen parallel liegen, am Bauche silbrig. Schuppen in 7 Längs- und in 27 Querreihen; obwohl einige derselben durchbohrt erscheinen, ist doch keine deutliche Seitenlinie zu sehen. Ganze Länge 39, Höhe 9, Länge des Kopfes 7 Millimeter. D. 8; A. 10. Caracas; in dem Guayre-Flusse von Gollner gesammelt."

Pœcilia Gillii.

Plate V. fig. 2, teeth.

Xiphophorus Gillii Kn. & St., 1866, Abh. Ak. Wien, X (1864), Ext. p. 25, pl. 4, fig. 1, — Mb. Ak. Wiss. Münch.

Pœcilia Gillii Gth., 1868, Tr. Zool. Soc. Lond., VI, 485; Eig., 1891, P. U. S. Mus., XIV, 65.

Pœcilia elongata Gth., 1866, Cat., VI, 342, — 1868, Tr. Zool. Soc. Lond., VI, 484, pl. 85, fig. 2; St., 1876, Sb. Ak. Wien, LXXIV, Ext. p. 19; Jor. & G., 1883, P. U. S. Mus., V, 623, — 1890, P. U. S. Mus., XII, 180; Jor., 1886, P. U. S. Mus., VIII, 368.

Pœcilia Boucardii Steind., 1876, Sb. Ak. Wien, LXXVI, Ext. p. 8, pl. 3, fig. 2–3.

Pœcilia chisoyensis Gth., 1866, Cat., VI, 342; Eig., 1893, P. U. S. Mus., XVI, 57.

B. 5; D. 10–9; A. 10–9; V. 6; P. 16; Ll. 29–31; Ltr. 9; Vert. 16+17.

Depressed and wedge-shaped anteriorly, compressed behind the pectorals, depth greater than length of head; caudal pedicel deep. Head broader than deep, narrowing forward and below, slightly arched across the crown, one fourth or less of the length to the base of the caudal. Snout as long as eye, broad, subtruncate, wedge-shaped as seen from the side. Mouth wide, directed upward; jaws weak, loosely joined, lower longer, upper shorter, protractile. Teeth slender in the outer series, movable, narrowed at the bases, broader and oar-shaped toward the apices, hooked; inner teeth in a band, very small, one cusped or with slight indications of lateral cusps; pharyngeal very slender, the series arranged in short rows of three to seven. Eye large, about half of interorbital space, as long as snout, one fourth of head. Dorsal origin little in advance of the middle of the total length, slightly behind that of anal in females. Anal of male farther forward, between the ventrals, second to fifth rays modified to form an intromittent organ, not as long as the head, with a fleshy lobe below the apex. Ventrals small, second ray elongate in males. Pectorals rather elongate, reaching behind the bases of the ventrals. Caudal deep, median rays as long as the head, posterior border forming a very blunt angle or rounded. Scales large. Intestine long.

Light yellowish to brownish or olivaceous, lighter below, silvery on cheeks and flanks, edges of scales darker. With or without narrow vertical bands of darker separated by spaces of similar width on the flanks, more distinct posteriorly. Top of head darker, with a lighter spot in the centre. With or without a darker vertebral line. Fins tipped with darker, or plain. Dorsal in cases darker near the base. Caudal sometimes with faint indications of transverse bands. Smaller specimens have transverse series of small spots, on the interradial membranes, on dorsal and caudal, the spot at the bases of the third and fourth rays of the dorsal being blackest.

Females up to four and one half inches; males much smaller.

Panama.

Pœcilia amazonica sp. n.

Plate IV. Fig. 9, teeth.

B. 5; D. 6; A. 9–8; V. 6; P. 13; Ll. 26–28; Ltr. 7–8; Vert. 15+15.

Closely allied to *P. vivipara*, but distinguished by a smaller dorsal and by the position of the lateral spot, present on the young. Head one fourth of

the length to the base of the caudal or one fifth of the total. Snout short, two thirds of eye; chin steep. Mouth narrow, hardly as wide as eye, directed upward; lower jaws longer, weak, loosely joined; upper short, protractile. Teeth broadened toward the apex; sharper in young; inner series in a band, one cusped, short, slightly hooked, not numerous. Eye large, longer than snout, one third of head, two thirds of forehead. Fins small, excepting caudal. Dorsal origin about midway from snout to end of caudal, little in advance of that of anal. On the male the entire base of the anal is forward of that of the dorsal; the anal process is comparatively short, as long as the head; and the second ray of the ventral is so much elongated as to reach behind the middle of the length of the anal. Pectorals pointed, reaching behind bases of ventrals. Caudal large, median rays longest. Scales large. Intestine long.

Light olivaceous, edges of scales darker, cheeks and belly silvery. Top of head dark, usually with a small spot of light color in the middle. A vertically oblong spot of dark color edged with light appears on the sixth and seventh scales behind the gill opening, and as many scales forward from the dorsal. On *P. vivipara* this spot is within three scales of the dorsal, and is retained on old specimens. Frequently there is a band of silvery from the eye backward. A dark blotch on the hind part of the belly above the ventrals, as in Gambusia, is of frequent occurrence on females; some of the males also have a large spot of dark in the same position but differing in character. Many have a large rounded black spot on the middle of the caudal pedicel at the base of the fin. Vertical streaks of darker and lighter on the flanks are common. Dorsal and caudal are sometimes mottled or transversely banded with puncticulations of black. A few of the males have a large spot of yellowish behind the black blotch on the caudal pedicel. Where this species is in contact with *P. vivipara* specimens are found with the lateral spots of both, one in each of the two positions.

Santa Cruz; Para.

Pœcilia pœciloides.

Lebistes pœcilioides De Filippi, 1861, Arch. per la Zool. l' Anat. e la Fisiol., I, 69, pl. IV, fig. 6; Jor., 1887, Pr. U. S. Mus., IX, 564.

Lebistes pœciloides Gthr., 1866, Cat., VI, 356.

"*Habitus Pœciliæ. Dentes supra et subtus in serie externa majusculis, compressi, incurvi: in serie interna rari distantes, minimi, conici. Pinnæ ventrales*

anali valde approximatæ, radio secundo longiore, in feminis protracto, ungulifero. Pinna analis radiis secundo et tertio in utroque sexu valde incrassatis et elongatis.

"La specie presente, finora la sola del genere [Lebistes] e che sarà denominata *Lebistes pœcilioides,* si distingue pei seguenti caratteri: P. 14; V. 6; A. 7; D. 9; serie delle squame $34\frac{3}{4}$. La perpendicolare calata dal primo raggio della dorsale corrisponde all' ultimo raggio dell' anale; tale carattere non dipende tanto dalla posizione all' indietro della pinna dorsale, come dalla posizione all' avanti della anale stessa. Il secondo raggio delle pinne ventrali nella femmina è non solo prolungato oltre la membrana, ma la sua estremità libera presenta una curvatura particolare come di un' unghia. Il secondo raggio dell' anale è pure nella femmina molto lungo, dilatato e depresso verso l' estremità.

"Il colorito è grigio-verdastro sul dorso, più chiaro sul ventre, con striscie nerastre sfumate verticali ai lati del corpo ed una di queste più distinta alla base della coda. La femmina ha una grande macchia azzura sul ventre."

Attains a length of an inch and a half. Barbados.

Pœcilia caucana.

Girardinus caucanus Steind., 1880, Denksch. Ak. Wien, XLII, 87, pl. VI, fig. 4–5, of extr.; Eig., 1891, P. U. S. Mus., XIV, 65.

D. 8; A. 9; V. 6; Ll. 26–27; Ltr. 8.

Body compressed, caudal pedicel deep. Head short, two sevenths to one fourth of the length to the base of the caudal; crown flat. Snout short, one third to three eleventhe of the head; chin steep. Mouth small, directed upward. Teeth in a single row, hooked, rather large as compared with the size of the mouth. Eye large, two fifths to one third of the head, longer than the snout. Forehead three fifths to more than one half the length of the head. Dorsal origin forward of the middle of the total length, opposite or slightly forward of that of the anal on females. Base of anal of male forward of that of dorsal; third to fifth rays elongate, nearly as long as the head, modified. The ventrals of the female are small; on the male they are longer, and the second ray is produced somewhat as in Heterandria. As figured by Steindachner these fins are longer than the anal on this sex. The anal process bears the soft lobes near the extremity as on males of the other species. Caudal large, moderately convex on hind border.

Brownish, edges of scales darker, in cases with a small black spot or dot on the bases of the anterior dorsal scales. Lower surfaces lighter. Dorsal

with a large blackish spot on the basal half, and a narrow edging of dark on the outer border. Caudal of some tipped with darker. Males with six to twelve narrow vertical bars of brownish on the flanks.

Males 32 mm.; females 43 mm. (Steindachner.)

The details given in the description are insufficient for a very satisfactory determination of the affinities or position of this species. The modification of the anal, however, with its short intromittent organ would place it in Pœcilia rather than in Girardinus.

XIPHOPHORUS.

Xiphophorus Heck., 1852, Sb. Ak. Wien, I (1848), 291; Blk., 1860, Cypr., 482, — 1863, Atl., III, 140; Kn. & St., 1865, Abh. Ak. Wien, 1864, X, ext. p. 24; Jor. & G., 1882, B. 16 U. S. Mus., 346.
Mollienesia Gthr., 1880, Intr., 617 (part).

Body more elongate than that of Mollienisia, resembling the more slender forms of Pœcilia, compressed, with a moderately deep caudal portion. Head depressed, crown slightly arched. Snout short, broad, subtruncate; chin short, steep. Mouth wide, directed upward; lower jaws longer, loosely joined; upper short, protractile. Dentition as in Mollienisia; an outer series of slender oar-shaped, hooked, movable teeth, behind which is a band of smaller pointed ones. Dorsal larger than the anal and originating farther forward. Anal opposed to the dorsal on males, with a short intromittent organ. Ventrals small. Caudal deep, convex on the female, with the lower lobe prolonged in a sword-shaped organ on the male. Scales large. Intestine elongate. Type *X. Hellerii* of Heckel.

Mexico; Central America.

The elongation of the body, and the modified lower lobe of the caudal fin of the male, with the peculiar subvertebral processes of this sex, are the characters on which is based the separation of this genus from Mollienisia and Pœcilia. In the species *M. petenensis* the caudal undergoes a similar change, though much less pronounced. On *X. Hellerii* the dorsal and ventrals are modified in the same manner as on Mollienisia, but not to the same extent. The differences are hardly sufficient for generic distinction, and, perhaps, a more consistent disposal of Mollienisia and Xiphophorus might place them as subgenera under Pœcilia.

Xiphophorus Hellerii.

Plate IV. Fig. 14, teeth; Plate VIII. Fig. 4, male.

Xiphophorus Hellerii Heck., 1852, Sb. Ak. Wien, I (1848), 291, pl. 8, fig. 1–3; Blk., 1860, Cypr., 485, —1863, Atl., III, 140; Trosch., 1865, Wirb. Mex., 104; Gth., 1868, Tr. Zool. Soc. Lond., VI, 485, pl. 87, fig. 2–6; Jor. & G., 1882, B. 16 U. S. Mus., 346.

Mollienesia (*Xiphophorus*) *hellerii* Gth., 1866, Cat., VI, 349.

Mollienesia hellerii Gth., 1880, Intr., 617.

Xiphophorus kelleri Eig., 1893, P. U. S. Mus., XVI, 57.

B. 5; D. 13–14; A. 8–10; V. 6; P. 14; Ll. 28–29; Ltr. 8; Vert. 30.

Moderately elongate, compressed, caudal pedicel deep. Head depressed, less than depth of body, little more than one fourth of the length to the base of the caudal. Snout short, as long as eye, broad, subtruncate; chin short, steep. Mouth wide, directed upward; lower jaws longer, loosely joined; upper short, protractile. Outer series of teeth slender, movable, oar-shaped, hooked; inner in bands, small, pointed. Eye large, longer than snout in young, two sevenths of head, more than half of interorbital space. Dorsal large, deep, becoming longer in males, originating farther forward than the anal in both sexes. The dorsal origin on the female is nearly midway from snout to base of caudal. Anal small, outer angle acute on the female; modified on the male to form an intromittent organ, the length of which is less than that of the head, and the end of which is barbed with several hooks. Caudal deep, scaly at the base, longer than the head, on males with the lower third produced into a long pointed appendage that varies greatly in individuals, in cases reaching a length equal to that of body and head. Scales large; lateral line distinct. Intestine elongate.

Light olivaceous to yellowish; cheeks and belly silvery. A frequent marking on the male is a black stripe from the snout, through the eye, along the flank and on the upper edge of the caudal appendage, and another stripe from the anal fin along the lower edge of the caudal. Between the stripes the caudal is yellow. The coloration varies excessively; from reticulations or longitudinal vittæ to scattered irregular blotches of black over head and body. Fins clouded, or dorsal with small spots irregularly placed or in transverse series. In cases the median band on the flank is blue and separates two yellowish or greenish bands which are bordered by blue above and below. The irregular blotches of black on some specimens are scattered over body, dorsal and caudal.

The largest male in the collection measures four and three eighths inches.

Mexico; Central America.

JENYNSIINÆ.

JENYNSIA.

Jenynsia Gthr., 1866, Cat., VI, 331, —1880, Intr., 616.
Fitzroyia Gthr., 1866, Cat., VI, 307.
Jenynsiina Gthr., 1866, Cat. VI, 300; Gill, 1894, Mem. Nat. Acad., VI, 133.

Intermediate in shape between Fundulus and Pœcilia, deep across the belly and in the caudal region. Mouth medium, oblique, lower jaw longer, upper protractile, symphyses rather firm. Teeth in bands, outer series larger, tricuspid. Snout not produced. Dorsal and anal behind the middle of the length, opposed, the latter originating a little backward of the former in both sexes, modified and possessing a tube in the male. Scales medium. Intestine longer than the body. Males rights and lefts.

Jenynsia lineata.

Plate I. Fig. 7, 8; Plate VIII. Fig. 2, 3, males.

Lebias lineata Jenyns, 1842, Beagle Zool., Fish, 116, pl. 22, fig. 2.
Jenynsia lineata Gthr., 1866, Cat., VI, 331; Perug., 1891, Ann. Mus. Civ., Gen., (2) X, 652; Eig., 1891, P. U. S. Mus., XIV, 65, — 1894, Ann. N. Y. Ac., VII, 635.
Cyprinodon lineatus Blkr., 1860, Cypr., 484.
Lebias multidentata Jen., 1842, l. c., 117, pl. 22, fig. 3.
Fitzroyia multidentata Gthr., 1866, Cat., VI, 307.
Cyprinodon multidentatus Blkr., 1860, l. c., 484.
Pœcilia punctata Val., 1846, C. V. Poiss., XVIII, 133; Blkr., 1860, l. c., 486; Gthr., 1866, Cat., VI, 347; Eig., 1891, P. U. S. Mus., XIV, 65.
Xiphophorus Heckelii Weyenb., 1874, Ned. Kon. Ak. Wetens., VIII, —1875, Per. Zool. Argent., p. 11, pl. 1 and 2, —, 1876, Nuev. Pesc. Mus. Nac., p. 17, pl. 4, fig. 15–16; Eig., 1893, P. U. S. Mus., 54.
Xiphophorus obscurus Weyenb., 1876, Nuev. Pesc., p. 18, pl. 4, fig. 17, 18.
Xiphophorus minor Weyenb., 1876, Nuev. Pesc., p. 20, pl. 4, fig. 19.

B. 5; D. 8–9; A. 9–10; V. 6; P. 15–16; Ll. 29; Ltr. 8–9; Vert. 14+17.

Form somewhat like that of Zygonectes but slightly deeper and more compressed posteriorly. Back not much arched, belly prominent. Head tapering, about two sevenths of the length without the caudal. Snout as long as the eye, blunt. Eye large, once in the snout, one and one half times in the interorbital space, three and a half times in the head. Mouth rather narrow, oblique, lower jaw longer, upper protractile, chin steep. Teeth small, in bands, tricuspid, outer series larger. Pharyngeal teeth hooked, with a shoulder. Excepting the caudal the fins are small. First ray of dorsal midway from head to base of caudal, over front edge of vent, half as long as second ray. Origin of anal below third or fourth dorsal ray. On breed-

ing males all the anal rays are elongate and closely applied. Ventrals medium, reaching the vent, first ray strong. Pectorals broad, rounded, not reaching bases of ventrals. Caudal broad, not as long as head, subtruncate. Scales large. Intestine elongate, convolute, filled with mud.

Olivaceous, darker on back, silvery on lower surfaces. Centres of scales a trifle darker. Caudal darker toward the end. Small specimens are lighter in color, and have three or four longitudinal series of brown spots, forming vittæ, along the flanks. Males are fully developed when one inch and a quarter in length. The largest specimen at hand measures three and one half inches. Montevideo; Maldonado.

ANABLEPINÆ.

ANABLEPS.

Plate IV. Fig. 1–2, teeth; Plate VI, VII.

Anableps Artedi, 1738, Gen. Pisc., 25, — Syn. Pisc., 43, — 1761, Seba, Thes., III, 108; Linn., 1740, Syst., ed. 2, 55, — 1744, ed. 4, 86, — 1747, ed. 5, 63, — 1748, ed. 6, 53, ed. 7, 53, — 1756, ed. 9, 55; Gron., 1754, Mus., I, 12, — 1756, Mus., II, 7, — 1763, Zooph., 117; Houtt., 1765, Nat. Hist., VIII, 92; Scop., 1777, Intr. Hist. Nat., 450; Walb., 1789, Art. Bibl. & Phil. Ichth., 129, 138, 142, — 1792, Art. Gen. Pisc., 160; Bloch, 1794, Ausl. Fische, VIII, 5; Bl. Schn., 1801, Syst., pp. xlviii, 389, — LaC., 1803, Poiss., V, pp. xx, 25; Cuv., 1817, R. An., II, 197, — 1829, ed. 2, II, 279, — 1836, ed. 3, I, 532; Flem., 1822, Phil. Zool., II, 386; Schinz, 1836, Nat. u. Abb. Fische, 216; Val., 1846, C. V. Poiss., XVIII, 245; Müll. & Tr., 1848, Fauna Guiana, 632; Gray, 1854, Gron., Cat., 192; Dum., 1856, Ichth., 426; Blkr., 1863, Atl. Ichth., III, 140; Gthr., 1866, Cat., VI, 327, — 1880, Intr., 617.

Anableptini Bonap., 1831, Saggio, 94, 113, — 1838 (in Cyprinidæ), Nouv. Ann. Sci. Nat., Bolog., II, 132, — 1839, Selach. Tab. Anal., 14, — 1840, Syst. Vert., 53, — Nouv. Ann., Bolog., IV, 195, — 1841, Linn. Soc. Tr., XVIII, 299, — 1850, Consp. Syst. Ichth.

Anablepidæ Swains., 1839, Classif., II, 190.

Anablepini Blkr., 1860, Cypr., 483.

Anableptinæ Gill, 1861, P. Phil. Ac., 3.

Anablepiformes Blkr., 1863, Atl. Ichth., III, 140.

Anablepinæ Gill, 1894, Mem. Nat. Acad., VI, 132.

Elongate, depressed anteriorly, compressed behind the body cavity. Head depressed, broad; orbits prominent above the crown. Eyes externally divided by a dark transverse band of the conjunctiva and internally in part by a lobe at each side of the iris. Mouth broad, anterior. Intermaxillaries protrusive, and, like mandibles, rather loosely joined. Teeth in a band, small, simple, hooked, outer series larger; pharyngeal teeth with a shoulder. Anterior nostril near angle of mouth, tubular, pendant; posterior a vertical slit near front of eye. Gill membranes united for a short distance, free from the isthmus. Six branchiostegal rays. Dorsal and anal small, behind the middle, dorsal farther back; ventrals small, separated. Anal of male tubular, scaly.

Intestine less than twice the total length. Scales medium, flat, harsh. Both sexes rights and lefts.

Fresh waters of Central America and the northern part of South America, venturing into brackish water near the shores.

Three species of Anableps are all that are positively known; these are easily distinguished by their colors or by their scales. Age, sex, or condition in the different types causes a considerable amount of modification in structure and appearance, for which allowances must be made.

		Page.
More than three narrow bands of brown along the flank;		
50–55 scales on the lateral line	*anableps*	77
Less than three bands or uniform;		
81–90 scales on the lateral line	*microlepis*	78
A yellow band on mid-flank;		
64–70 scales on the lateral line	*Dowii*	79

The fishes of this genus swim at the surface; their bodies are constructed to withstand a great amount of buffeting. Integuments and bones are firm and strong. The opercular bones are moderately broad and are closely joined; with the urohyal and the wide vertical expansion of the shoulder girdle they furnish a rigid and close chamber for the gills. The body walls also are firm. The ribs are short; the broadness of the back is due to the elongation of the parapophyses, which are wide and concave or troughed and chambered on the upper side. A greater number of vertebræ in these species, than in those of other genera of the family, is in keeping with a greater comparative amount of activity. The evidence of the active Anableps, from the warmest of the waters, taken in connection with that of the more sluggish Orestias, from the cold lakes and streams of the Andes, does not support the conclusion recently advanced that warmer waters and greater activity are productive of a smaller number of vertebræ, but proves, instead, that comparatively the greater number of vertebræ obtains with the greater activity whether in warm waters or in cold. A prevalent idea gives this genus but a single nostril; there are actually two, the posterior being narrow and vertical and situated near the eye. The jaws are not firmly joined at the symphyses; the internarial process of the intermaxillaries is short, merely a blunt angle. The maxillaries do not form part of the edge of the mouth; they do not meet; the upper half of each is wide, rounded, and extends horizontally toward the middle line in front of the skull. The skull is flattened, except at a strong frontal expansion that arches up and around

the upper side of the orbit for the protection of the eye. In the bases of the pectorals the carpal elements are nearly obsolete, those remaining are very small; the clavicula and other coraco-scapular bones are thin and broad, but strong and firmly attached. Posteriorly the two processes of the hindmost vertebra form a fan of medium size, in which the line of junction is distinct. All of the species in the genus, as known at present, have a convex posterior margin to the caudal fin. The halves of the pelvis are widely separated. More than half of the length is occupied by the body cavity.

In its earlier stages the young Anableps bears some resemblance to Rivulus. At this time the eye is not traversed by the band of the conjunctiva, and the pupil is not divided by projecting lobes of the iris. The eyes are not very prominent above the crown; the latter is arched. The dark band across the cornea, the bony shield above the orbit, and the lobes in the pupil, dividing it into an upper section and a lower, are of later appearance. A peculiar feature of the embryo is the abdominal pouch, or bag, containing the intestines, below the permanent ventral walls. This pouch gives the embryo of Anableps an outline similar to that of Gambusia (see Plate VI. Fig. 1). It extends from the shoulder girdle to the vent, separates the ventrals permanently, and communicates with the body cavity by a slit that extends from the vent forward nearly to the coraco-scapular arch. Its surface bears numerous lines of more or less confluent papillæ, converging from the body downward to a point near the middle of the lower side. These papillæ mark the courses of the blood vessels from which they rise and into which they pour the food supply drawn from the portion of the egg remaining with the embryo inside the egg-envelopes. Near the heart, near the vent, and around the lower point of convergence the papillæ are larger, in cases uniting and forming continuous ridges. Possibly in addition to their absorbent function they also serve a purpose in oxygenating the blood. They persist, after the egg envelopes are ruptured, for a time, until the young in the ovarian chamber have reached a length of about two inches; then the sac becomes thin and with the papillæ is itself absorbed. The yelk is exhausted by the time the embryo has attained a length of half an inch; the continued growth of body and sac is, within the egg coverings, nourished from the included albumen, or later, from the liquids by which the sac is surrounded in the cavity of the ovary. After the fish has nearly completed its prenatal development the intestines gradually withdraw from the bag into the

abdomen and the permanent ventral walls coalesce from the pectorals backward, and to some extent from the vent forward, closing the fissure, separating the body cavity from the pouch, which shrinks, shrivels up, and is absorbed or otherwise destroyed. Traces of the cleft remain for a time; finally these are covered by scales and obliterated.

The entire fissure represents the umbilicus. Apparently the disappearance of the sac precedes the extrusion and independent life of the young fish but a short time, during which the substance of the pouch itself and the liquid contents of the ovarian cavity furnish subsistence.

Valenciennes (1846) says the sac enters the abdomen and that the size and number of the fœtuses occasion the permanent separation of the ventral fins. In Wyman's work (1857) both of these points are correctly treated. Valenciennes describes the rows of papillæ as vascular striæ, in which he is nearer the truth than Wyman is. Fertilization takes place, so far as the action of the spermatozoon is concerned, as in viviparous Cyprinodonts in general. Wyman's idea, that the spermatozoon "must act simply by its presence on the surface of the egg-sac or by an endosmosis of its fluid contents through the membranes by which the ovum is invested," is incorrect. Valenciennes described the sexual organs and decided from the scales and their arrangement on the male organ that it was not intromittent, but, "s'il y a un accouplement nécessaire à la fécondation des œufs dans l'intérieur de la femelle, il ne peut se faire que par une simple juxtaposition de l'extrémité de la verge du mâle dans la fente allongée et vulviforme des sacs ovariens de la femelle." His conjecture is in part borne out by the facts of the anatomy of the organs, which also discloses a great deal he has overlooked. The structure of the anal of the male, after its modification, is such as to allow a very limited motion downward, but provides much greater freedom of movement sideways. The purpose of this lateral reach is evident at once on comparison of a number of specimens of both sexes. Copulation is effected by the male, at the side of the female, bending the anal to one side so as to bring the extremity of the organ into the opening to the ovaries of the female. In the posterior half of the adult male organ a bend is made to either the right or the left as may be (Plate VII. Fig. 2, 3). Of seventeen males, the bend is to the right on eleven, to the left on six. Further than this, there is a small fleshy tubercle at the side of the seventh or the sixth anal ray, at the beginning of the outer half of its length. When this prominence is on the left side the organ bends to the right, or if on the right side

the bend is to the left. The canal for urine and sperm lies on the short, concave side of the bend whether to right or left. These peculiarities obtain in each of the species of the genus. Turning to the females of *A. anableps* we find a large scale to cover the opening to ureters and ovary. This scale may be called a shutter, a foricula; it is unattached at one side or the other so as to open to the right on some individuals or to the left on others (Plate VII. Fig. 1, 4, 5). Thirty-four females of this species have the shutter free to open to the left, while on twenty-one others it opens to the right. From all this we must conclude that in Anableps the individuals of the sexes are rights and lefts, dextral or sinistral. Nearly three fifths of the males were rights, as we have seen above; these naturally would couple with females that were lefts, in support of which we find about three fifths of those in this collection to have the shutter opening to the left side. On one male of *A. microlepis* the anal bends to the right, on another to the left. The female of this species apparently has not the large scale for a shutter that is seen on *A. anableps*, but the opening is situated in a groove or fold of which the scales of one side overlap those of the other. Two of these females are lefts, and two are rights. Of three males of *A. Dowii* two are rights; one is a left. The shutter of the female Dowii is like that of *A. microlepis*. The anal of the male Anableps differs from that of other Cyprinodonts, excepting Jenynsia, in that the canal extends the entire length of the rays.

The egg of Anableps differs from that of allied Cyprinodonts mainly in the contained amount of nutriment for the embryo, in addition to the yelk. Very young embryos have particles of the yelk in the bag with the intestines. The albuminous matter is great in amount, and, wholly or in part, usually lies in contact with the papillæ on the outside of the sac, the hardened masses (in alcohol) showing the indentations of the series. On Plate VI. Fig. 2, 4, the letter *w* indicates the positions of the albumen on a couple of embryos. The papillæ of the bag do not fit into pits on the inside of the general envelope of the egg; in fact, few if any of them come in contact with the investing membrane, as is evident from the position assumed by the embryo around its bag (Fig. 2, 3). The embryo has freedom of movement; it is not attached to the egg coverings by the bag. The amount of albumen to be found within the egg decreases as the embryos enlarge; and, comparatively, the papillæ are larger on the younger specimens. The series of papillæ mark the courses of the blood vessels into which they pour the material absorbed. The arrangement and connections of the vessels are sug-

gestive of what obtain in young of Rivulus and Gambusia. As a whole the circulation of the bag amounts to what in the adult would correspond to the sinus emptying into the auricle, with the possible addition of a portion of the ventral cutaneous vein. As worked out from the specimen at hand, a vessel sent down from the cardinal just behind the gills at each side, passes at the side of the heart, to the upper edge of the bag, where, as it extends backward, it sends downward branches which branch again and again, then converge and unite toward the point, near the middle of the lower surface of the sac, at which they discharge their contents, with what has been added by the papillæ, into a vein or sinus (Plate VI. Fig. 1, 3, *ss*) that lies free from and within or above the walls of the bag and runs forward and up to the auricle, into which it discharges. Beside the two anterior supply vessels another passes down from the main vessel above the bladder, below the vertebræ, to the left side of the vent below which it forks and sends a branch forward along the upper edge of the bag at each side (Fig. 1, *s'*, Fig. 7.) The branches and branchlets of this vessel are similar to those of the anterior portions of the bag, and they discharge into the same vessel (Plate VI. Fig. 1, 3, *ss*). At this stage the auricle lies below the ventricle (Fig. 12, 13). As the bag atrophies the anterior vessels (*s*, in Fig. 12) at each side of the auricle unite with the median (*ss*, of the same figure) to form the sinus emptying into the auricle (*s*, in Fig. 10, 11). The lateral vessels of the upper edge of the bag apparently give way to the ventral cutaneous vein. The branchlets and the long median vessel (*ss*) are absorbed with the bag itself. In the change to the adult condition the auricle and ventricle change places so that the latter eventually lies lower than the former, though not directly below it. The heart of the young is outlined on Plate VI. Fig. 6, 12–14, and that of the adult in Fig. 10, 11. The bladder also undergoes considerable changes in the young Anableps, as may be seen by comparison of Plate VI. Fig. 1 (*bl*), with Plate VII. Fig. 6, 11–15.

Valenciennes, 1846, XVIII, 259, Atlas, pl. 539, has described and figured the bladder of the male of Anableps, but from a very imperfect understanding of the structure. He ignores the muscular valve at the junction of the seminal and urinary ducts (*x*, in Plate VII. Fig. 6, 11–15), a structure which represents the external openings of the ancestral form, and he says that urine and semen are discharged into a common receptacle. "Les uretères sont deux longs tubes grêles, attachés aux reins dans presque toute la longueur du viscère. Ils se terminent dans ce poisson tout autrement que

dans les autres. Dans le mâle, les uretères donnent dans la vessie fibreuse, dans laquelle les laitances versent la liqueur séminale; dans la femelle, c'est à l'extrémité de l'oviducte. On doit se rappeler que, dans tous les autres poissons, l'urine sort par un orifice distinct de celui de l'ovaire ou des laitances." "La communication entre la vessie et les sacs de la laitance est de plus manifeste par la simple insufflation." "On peut donc la considérer comme une vessie urinaire, parce qu'elle recoit les uretères, et en même temps comme une sorte de vésicule séminale, où le canal déférent des testicules verse la laitance." Such is the description one might take from the outside (see Plate VII. Fig. 11). A very different story is to be taken from the interior (Fig. 12, 13). The receptacles for the urine and for the semen are really distinct; they are separate to the base of the first anal ray, where their ducts join in a common tube. The muscular valve (*x*, Plate VII. Fig. 6, 11–13) at their junction represents the external openings on males of such cyprinodonts as do not possess the added canal common to seminal and urinal discharges. This common canal recalls the structure in similar use among higher vertebrates. A structure almost identical, corresponding so far as concerns the common tube on the anal fin, is seen on the females of certain Funduli, *F. heteroclitus* for instance, on which ovaries and bladder empty into a single tube at the base of the anal, the tube being extended downward upon the first anal ray half or more of the length of the fin. The growth of the tube in the young male of Anableps, also, presents much similarity with that seen on the females of these Funduli. In the early stages, sketched on Plate VII. Fig. 7–9, at different ages, the anal of these young males shows close resemblances to that of the adult female in the other genus. The advance from the ordinary in each case, before the male fin itself transforms, is simply the extension of the tube downward, beyond the separate ducts, along the anterior edge of the fin. A band of inelastic tissue (*p*) crosses the neck of the bladder immediately behind the urinary chamber, above the origin of the tube through which it empties, in such a manner that by contraction of a muscle at each end of it, lying just outside of each ventral fin, the urine is prevented from escape while the contents of the seminal chamber are forced out through the valve (*x*) and the tube on the anal fin (Plate VII. Fig. 6, 15). The great muscles (*n*) controlling the movements of the anal of the male lie close behind and above the bladders and no doubt also act as compressors. The arrangements for keeping the semen separate from the urine are decidedly effectual. The bladder of the female,

the ovary, and the disposition of their openings, above the shutter, are indicated, from a dextral female, on Plate VII. Fig. 14. Valenciennes' statement, "Quant à la femelle, ses ovaires sont doubles; mais le gauche est beaucoup plus gros que le droit; celui-là ne dépasse pas cependant la portion élargie du foie," no doubt was correct for the individual he had in hand. It is incorrect as a general description. In different females the ovaries vary greatly: in some cases one side is the larger, in other specimens it is the other side, and occasionally the ovary appears to be single. Fig. 5 of Plate VII. was taken from a female in which both sides of the ovary were well developed, the right half being a trifle the larger, while Fig. 4 of the same plate represents a specimen in which the right side of the ovary apparently is so enormously enlarged as to nearly fill the entire abdominal chamber without any indication of a left side or of a doubled ovary. In this individual the intestines were empty and crowded far forward, while the liver was greatly reduced in size, indications that before capture the usual feeding habits had been suspended for a time. An intestinal fold, seen in Fig. 5 of Plate VII, in front of the middle of the ovary, is bisected in Fig. 16 of the same plate. Each kidney and each testis pours its secretions into its proper receptacle by a distinct canal; the openings into the chambers are separate.

Anableps anableps.

Plate IV. Fig. 1, teeth; Plates VI., VII.

Anableps Artedi, 1738, Gen., p. 25, — Syn., p. 43, — 1761, Seba, Thes., III, 108, pl. 34, fig. 7; Gron., 1754, Mus., I, 12, pl. 1, fig. 1–3, — 1763, Zooph., 117, pl. 1, fig. 1–3.

Anableps anonymus Linn., 1740, Syst., ed. 2, 55, — 1744, ed. 4, 86, — 1747, ed. 5, 63, — 1748, ed. 6, 53, — ed. 7, 53.

Anableps anableps Linn., 1756, Syst., ed. 9, 55; Jor., 1887, P. U. S. Mus., IX, 564; Eig., 1891, P. U. S. Mus., XIV, 65, — 1894, Ann. N. Y. Ac., VII, 629, — B. U. S. F. Com., 404.

Cobitis anableps Linn., 1758, Syst., ed. 10, I, 303, — 1759, An. Spec., 100, — 1760, Syst., ed. 11, I, 303, — 1764, Mus. Ad. Fridr., II, 95, — 1766, Syst., ed. 12, I, 499, — 1767, ed. 13, I, 499; Müll., 1774, Linn. Syst., IV, 282, pl. 8, fig. 1; Neuer Schauplatz, 1775, I, 283, IV, 38; Blumenb., 1780, Naturgesch., 272; Herm., 1783, Tab. Affin., 367; Borowski, 1784, Abb. Fische, 123; Bonn., 1788, Ichth., 148, pl. 61, fig. 240; Gmel., 1789, Syst. Linn., I, 1348; Walb., 1792, Art. Gen. Pisc., 11, 160; Donnd., 1798, Zool. Beytr., 574; Hermann, 1804, Obs. Zool., 307; Turt., 1806, Syst., I, 836.

Anableps tetrophthalmus Bloch, 1794, Ausl. Fische, VIII, 7, pl. 361, — 1801, Schn. Syst., pp. xlviii, 389, pl. 76, fig. 1–2; Shaw & Nodder, 1801, Viv. Nat., XIII, pl. 503; Shaw, 1804, Zool., V, 7, pl. 94; Cuv., 1817, R. An., II, 198, — 1829, R. An., ed. 2, II, 279, — 1836, ed. 3, I, 532; Flem., 1822, Phil., Zool., II, 386; Schinz, 1836, Nat. u. Abb., 216, pl. 74, fig. 2; Val., 1840, R. An., ed. ill., Poiss., 226, pl. 94, fig. 3; M. & Tr., 1848, Schomb. Guiana, 632; Gosse, 1851, Fishes, 205; Rich., 1860, Mus. Nat. Hist., Fishes, 153, pl. 4, fig. 18; Edw., 1861, Voy. Amaz., 50; Gill, 1861, P. Phil. Ac., 5; M. Edw., 1862, Leç. Phys. Nat., VII, 331; Blkr., 1863, Atl. Ichth., III, 140; Gthr., 1866, Cat., VI, 337; Ag., 1868, Jour. Brazil, 143.

Anableps gronovii Walb., 1792, Art. Gen. Pisc., 160; Val., 1846, C. V., Poiss., XVIII, pl. 538, 539; Wyman, 1857, Jour. B. N. H. Soc., VI, 432, pl. 17; Blkr., 1860, Cypr., 487; Ryder, 1886, P. U. S. Mus., VIII.

Anableps surinamensis LaC., 1803, Poiss., V, 25.
A. lineatus Gray, 1854, Gron. Cat., 192.

B. 6; D. 8; A. 10–11; V. 6; P. 22–24; Ll. 50–55; Ltr. 11; Vert. 24–25 + 27–28.

Head four and one half to five times in the length, without the caudal. Interorbital space wider than that in *A. microlepis;* frontal shield, around the eye, more regularly rounded and less angular forward. The ocular shield is higher than that of *A. Dowii*, consequently the upper half of the eye does not look quite so directly upward.

Back olivaceous or greyish brown to yellowish, in many cases with a light streak from the dorsal to the back of the head where the line branches toward each eye. Flank with three to five darker longitudinal bands, two or three of which are usually more distinct and complete than the others. Two of the bands are sometimes joined above the vent. On the caudal section there are from two to five bands, more often three with broken pieces; at the base of the caudal the upper bands either turn downward and join the lower or break in pieces forming vertical spots and bars. Fins uniform to brownish, dusky or clouded, pectorals rather darker. Lower surface yellowish, the yellow color extending more or less up the flanks. All the data given above in discussing the genus concerning the embryo relates especially to this species.

The specimens under examination were collected at Trinidad, Surinam, Para, Curuca, Lake Saraca, Serpa, and Arary. The largest are about ten inches in length.

Anableps microlepis.

Plate IV. Fig. 2, teeth.

Anableps microlepis Müller & Troschel, 1844, MB. Berl. Akad., 36, — Trosch., 1845, Arch. Naturg., II, 200 (Abst.), — M. & Tr., 1848, Fauna Guiana, 632, — Blkr., 1860, Cypr., 487, — Gill, 1861, P. Phil. Ac., 5, — Gthr., 1866, Cat., VI, 338, — Jor., 1887, P. U. S. Mus., IX, 564.
Anableps coarctatus Val., 1846, C. V., Poiss., XVIII, 266.
Anableps elongatus Val., 1846, C. V., Poiss., XVIII, 267, pl. 541, — Blkr., 1860, Cypr., 487, — Gill, 1861, P. Phil. Ac., 6, — Eig., 1891, P. U. S. Mus., XIV, 65.
Anableps Home, 1828, Lect. Comp. Anat., VI, pl. 38, 52, 53, — Smith, 1850, P Z. S. Lon., 53.

B. 6; D. 10–11; A. 10–11; V. 6; P. 20–22; Ll. 81–90; Ltr. 17–18; Vert. 24 + 28.

On an average specimen the length of the head is about two ninths of the length of the caudal, or three sixteenths of the total. The crown is less flat and the interorbital space is narrower than in the other species. The

frontal shield around the orbit is less regularly curved, more angulate forward, the posterior margin of the caudal is more oblique, the scales are more harsh to the touch, and the colors are more nearly uniform than in either of the others. The caudal has a pointed appearance, the longest rays being below the middle. Because of the greater height of the orbital shield the eye does not look upward so directly as in *A. Dowii*. The snout is hardly so near truncate as that of *A. anableps*. A greater roughness of the scales is due in part to the striation and also to the greater firmness of the small spines around the free edges of the scales.

A male of four and one eighth inches has two narrow longitudinal bands of brownish, separated by yellowish, along each flank; above these on the caudal section there is another fainter streak. Eight inch females have two faintly indicated yellowish bands with series of small brownish spots or vittæ, more numerous posteriorly. Others of six to twelve inches are nearly to quite uniform greyish brown on the back and yellowish beneath, which are the ground colors in all cases.

Representatives from Para to Surinam.

Anableps Dowii.

Anableps Dowei Gill, 1861, P. Phil. Ac., 4, — Eig., 1893, P. U. S. Mus., XVI, 57. *A. Dowi* J. & G., 1883, P. U. S. Mus., V, 373.

Anableps Dovii Gthr., 1866, Cat., VI, 338; Jor., 1886, P. U. S. Mus., VIII, 368.

B. 6; D. 10; A. 11; V. 6; P. 23; Ll. 64–70; Ltr. 14–15; Vert. 24 + 23.

Head four and one fourth to four and two thirds times in the length to the caudal, or four and two thirds to five and one third times in the total. Interorbital space wider and flatter, orbital shield more regular, scales larger and smoother, and caudal more regular in outline than in *A. microlepis*. Color darker, bands fewer, and orbital shield lower than in either microlepis or anableps. With a lower orbital shield the eye is enabled to look both more directly sidewise and more directly upward than in those species.

In the upper half of the entire body the color is a rich dark brown; below this there is a yellow band along the flank separated from the yellow of the ventral surface by a brown band, from which little branches extend upward across the yellow band toward the brown of the back. Dorsal and caudal, with its base, brown. Pectorals brown in upper half, yellow in lower. Cheeks brownish yellow; throat whitish. Specimens from Chiapas,

Mexico, and the Pacific coast of Central America. Largest eight and a half inches in length. Reaching a length of ten inches or more.

GAMBUSIINÆ.

BELONESOX.

Belonesox Kner, 1860, Sb. Ak. Wien, XL, 419; Blkr., 1863, Atl. Ichth., III, 140; Gthr., 1866, Cat., VI, 333.
Belonesocini Blkr., 1863, Atl., III, 140.

Elongate, compressed; head long, pointed; caudal region moderately deep. Snout long, pointed; both jaws produced, lower longer. Mouth wide, much developed laterally. Teeth numerous, simple, in cardiform bands. Intermaxillaries not anchylosed, but together forming an elongate triangular plate. Mandibles elongate. Scales medium. Anal modified in the male. Dorsal and anal behind the middle of the body, the former originating farther backward. Intestine short.

Central America to Mexico.

Belonesox belizanus.

Belonesox belizanus Kner, 1860, Sb. Ak. Wien, XL, 419, with plate; Blkr., 1863, Atl. Ichth., III, 140; Gthr., 1866, Cat., VI, 333; Jor., 1887, P. U. S. Mus., IX, 564; Eig., 1893, P. U. S. Mus., XVI, 57.

B. 6; D. 9; A. 10–11; V. 6; Ll. 56–63; Ltr. 18.

Head one third or more and depth of body one fifth or less of the length to the caudal. Upper surface of intermaxillary plate as long as postorbital part of head. Base of dorsal in females equals half its distance from the caudal, in males more than half. Anal process of male two thirds as long as head, composed of three rays. Base of dorsal farther back than that of anal. Caudal broad, hind margin convex.

Brownish olive above; flanks with black dots in longitudinal series; a black spot on the middle of the base of the caudal.

Honduras; Guatemala; Mexico. (Günther.)

PSEUDOXIPHOPHORUS.

Pseudoxiphophorus Blk., 1860, Cypr., 482, — 1863, Atl. Ichth., III, 140; Gth., 1866, Cat., VI, 332.
Pœciliodes Steind., 1863, Sb. Ak. Wien, XLVIII, 176.

Shaped like Gambusia. Body compressed, caudal pedicel steep; head depressed, crown flat. Snout broad, blunt; chin steep. Mouth large, wide;

mandibles strong, firmly joined; intermaxillaries short, protractile. Teeth conical, hooked, in bands, outer series larger. Branchiostegal rays six. Dorsal large, larger than the anal, originating in the forward half of the total length and in advance of the anal in the female. Anal of male farther forward and modified into an intromittent organ. Scales large. Intestine short.

The pharyngeal teeth in the specimen dissected are without a shoulder (Plate III, Fig. 6, *p*). Whether this peculiarity is not lost in aged individuals can only be determined by further examinations.

Mexico to Central America.

Pseudoxiphophorus bimaculatus.

Plate III. Fig. 6, teeth; Plate VIII. Fig. 9, male.

Xiphophorus bimaculatus Heck., 1852, Sb. Ak. Wien, I, 297, pl. 9, fig. 1–2.

Pseudoxiphophorus bimaculatus Blk., 1860, Cypr., 485, — 1863, Atl. Ichth., III, 140; Trosch., 1865, Wirb. Mex., 104; Gth., 1866, Cat., VI, 332; Eig., 1893, P. U. S. Mus., XVI, 57; Woolm., 1894, B. U. S. F. Com., 65.

Pœciliodes bimaculatus Steind., 1863, Sb. Ak. Wien, XLVIII, 176, pl. 4, fig. 2; Trosch., 1865, Wirb. Mex., 104.

Pseudoxiphophorus reticulatus Trosch., 1865, Verz. Wirb. Mex., 104; Gth., 1866, Cat., VI, 333; Eig., 1893, P. U. S. Mus., XVI, 57.

B. 6; D. 14–15; A. 10–12; V. 6; P. 14–15; Ll. 28–31; Ltr. 8–9; Vert. 15 + 17.

In shape resembling *Fundulus heteroclitus*. Caudal section deep, strong; back moderately arched. Head depressed, flattened on the crown, one fourth of the total length, three tenths of the length to the base of the caudal, more than depth. Snout broad, blunt, rounded, as long as eye. Mouth wide, slightly oblique; lower jaws longer, firmly joined; upper short, protractile. Teeth conical, hooked, in bands, outer series larger; pharyngeal in the specimen dissected, without a shoulder. Eye large, as long as snout, two sevenths of head, little, if any, more than half of forehead. Dorsal large, base as long as head, or longer than its distance from the head, low, originating in front of mid length and, in the female, little farther forward than the anal. Base of anal short, not half as long as that of dorsal. Anal of male advanced and modified to form an intromittent organ, one third or more of the total length of the fish. Ventrals small. Caudal broad, subtruncate to convex on hind border. Scales large, on mid flank short and deep.

Olivaceous to brownish, light to dark, reddish to yellowish, edges of scales darker; belly lighter, white to yellowish, with a metallic lustre. In

cases the scales have a wide posterior edging of black. On some the median row on the flank has a wide black tip. A dark patch behind the eye is common, as, also, the black blotch on the upper half of the base of the caudal. Occasionally a small whitish spot appears on the middle of the scale. Fins dusky to almost black; caudal with or without a light transverse streak behind the black blotch. On very dark colored individuals the caudal is nearly black and the blotch is indistinct.

Attaining a length of four inches.

Mexico.

GAMBUSIA.

Gambusia Poey, 1855, Mem., I, 382, 390, — 1861, Mem., II, 383, — 1868, Repert., II, 209, 410; Gth., 1866, Cat., VI, 333, — 1880, Intr., 616; Jor. & G., 1882, B. 16 U. S. Mus., 344.

Gambusiinæ Gill, 1894, Mem. Nat. Acad., VI, 133.

Body rather short and stout; caudal pedicel deep; head depressed. Snout broad, blunt. Chin moderately steep. Mouth large, wide, resembling that of Zygonectes; mandibles strong, firmly united; intermaxillaries shorter, protractile. Teeth conical, in cards, hooked, outer series larger. Branchiostegal rays usually six. Dorsal originating behind the middle of the body; anal origin farther forward, fin more advanced and modified to form an intromittent organ in the male. Intestine rather short.

The separation of this genus from Heterandria seems to be fully warranted by the shape of the teeth, the structure of the mouth, the number of branchiostegal rays, and other particulars. Unless otherwise specified the species are described from females.

Gambusia Holbrookii.

Plate IV. Fig. 3, teeth; Plate VIII. Fig 5; Plate XI. Fig. 4–13.

Heterandria Holbrookii (Ag.) Grd., 1859, P. Phil. Ac., 61.

Gambusia Holbrookii, Blk., 1860, Cypr., 485; Put., 1863, B. M. C. Z., 14; Gth., 1866, Cat., VI, 334; Goode, 1880, P. U. S. Mus., II, 118.

Gambusia patruelis Jor., 1881, P. U. S. Mus., III, 21, — 1885, P. U. S. Mus., VII, 322; Ryder, 1882, Amer. Nat., Feb., — 1886, P. U. S. Mus., VIII, 143, pl. 6–10; Jor. & G., 1882, B. 16 U. S. Mus., 893, — 1887, P. U. S. Mus., IX, 26; Jor. & M., 1885, P. U. S. Mus., VII, 235; Gilb., 1890, B. U. S. F. Com., 228, — 1891, B. U. S. F. Com., IX, 158; Hensh., 1891, B. U. S. F. Com., IX, 374; Bean, 1892, P. U. S. Mus., XIV, 92; Smith, 1892, B. U. S. F. Com., X, 69, pl. 20, fig. 1; Woolm., 1892, B. U. S. F. Com., X, 294, 296, 298, 300, 301.

Gambusia patruelis holbrookii Jor. & G., 1883, P. U. S. Mus., V, 587.

Haplochilus melanops Cope, 1870–77, P. Am. Phil. Soc., XI, 457.

Zygonectes melanops Jor., 1876, Man. Vert., 252; Jor. & C., 1877, B. Buf. Soc., III, 142.

Zygonectes (*Micristius*) *melanops* Jor., 1878, Man. Vert., 264, — B. U. S. G. Sur., IV, 433; Jor. & G., 1882, B. 16 U. S. Mus., 340.

Zygonectes atrilatus Jor. & B., 1878, B. 12 U. S. Mus., 84; Jor. & G., 1883, P. U. S. Mus., V, 258.

Zygonectes (*Micristius*) *atrilatus* Jor. & G., 1882, B. 16 U. S. Mus., 340.

B. 6; D. 8; A. 10–11; V. 6; P. 12–13; Ll. 30; Ltr. 9–8; Vert. 14 + 18.

Moderately stout, compressed behind the head, caudal pedicel deep. Head depressed, less than depth of body, about one fourth of the length to the base of the caudal; crown flattened. Back with a low arch; most sharply curved at the origin of the dorsal. Snout longer than eye, broad, blunt. Mouth oblique, wide; lower jaws longer, firmly united; upper protractile. Eye medium, less than snout, half of interorbital space, about two sevenths of head. Teeth in bands, conical, hooked, outer series larger. Dorsal, anal, and pectorals medium, rounded; dorsal origin behind the middle of the total length, nearly above the hindmost ray of the anal. Base of anal almost or quite forward of that of dorsal. Ventrals small. On males the anal and ventrals are much nearer the bases of the pectorals, and the second, third, and fourth anal rays form an elongate styliform process, about one fourth of the total length of the body. Caudal large, rounded. Extended the intestine hardly reaches the base of the caudal. Seven rays in the dorsal are more often borne by males than females.

Olivaceous to yellowish, edges of scales darker, light to yellow or silvery beneath. Top of head dark, commonly with a whitish spot in the middle. A darker vertebral streak. A black spot from the eye down and backward. Cheeks silvery to bronzed or brown. With or without a black spot or spots in front of the anal on the side of the abdomen. Dorsal and caudal with small spots irregularly disposed or in one to several transverse series, rarely plain. Occasional individuals are nearly uniform in color. Southward the edges of the scales become darker, a small black spot sometimes is seen on the base of each scale, and the spot below the eye is frequently indistinct or absent. Occasionally black blotches are scattered over the body and fins; some specimens are almost black.

The range of this species extends from Virginia to Alabama. In the tributaries of the Mississippi and westward to Mexico it gives way to *G. patruelis*, to which it is very closely allied.

A female of two and one half inches is uncommon; males are hardly half as large. Figures 4 and 5 of Plate XI. represent extremes in blotching and in length of pectorals. The variation affects both sexes. Some of the individuals colored thus are badly infested by parasites, which may or may not be connected with the cause of the peculiar modification.

Gambusia patruelis.

Heterandria patruelis B. & G., 1854, P. Phil. Ac., VI, 390.

Gambusia patruelis Grd., 1859, P. Phil. Ac., 121, — Mex. Bd. Sur., Fishes, 72, pl. 39, fig. 1–7; Jor. & C., 1877, B. Buf. Soc., III, 142; Jor., 1878, B. U. S. G. Sur., IV, 434, — 1885, P. U. S. Mus., VII, 320, — 1887, R. U. S. F. Com., 338; Garm., 1881, B. M. C. Z., VIII, 93; Hay, 1883, B. U. S. F. Com., II, 66, 74; G. & B., 1883, P. U. S. Mus., V, 239; Jor. & G., 1882, B. 16 U. S. Mus., 345, — 1883, P. U. S. Mus., V, 257, — 1887, P. U. S. Mus., IX, 8, 11, 14, 16, 17, 19, 21, 22, 24; Woolm., 1892, B. U. S. F. Com., X, 263, 273; Everm., 1892, B. U. S. F. Com., 1891, p. 88; Garm., 1894, B. Essex Inst., XXVI, ext. p. 47; Eig., 1894, R. Ind. Biol. Surv., 94.

Zygonectes patruelis Blk., 1860, Cypr., 486.

Heterandria affinis B. & G., 1854, P. Phil. Ac., VI, 390; Blk., 1860, Cypr., 485.

Gambusia affinis Grd., 1859, P. Phil. Ac., 120, — Mex. Bd. Fish, 72, pl. 39, fig. 12–15; Blk., 1860, Cypr., 485; Gth., 1866, Cat., VI, 336; Jor. & C., 1877, B. Buf. Soc., III, 142; Jor., 1878, B. U. S. G. Sur., IV, 434, — 1887, R. U. S. F. Com., 838; Jor. & G., 1882, B. 16 U. S. Mus., 346; Everm. & K., 1894, B. U. S. F. Com., 1892, pp. 66, 75, 76, 78, 79, 81, 83, 87, 89, 90, 92, 107, pl. 25, fig. 2.

Gambusia gracilis Grd., 1859, P. Phil. Ac., 121; Trosch, 1865, Verz. Wirb. Mex., 107; Jor. & C., 1877, B. Buf. Soc., III, 142; Eig., 1893, P. U. S. Mus., XVI, 57.

Zygonectes gracilis Blk., 1860, Cypr., 486.

Gambusia humilis Gth., 1866, Cat., VI, 335, Jor. & G., 1882, B. 16 U. S. Mus., 345; Jor., 1887, R. U. S. F. Com., 838.

Gambusia holbrookii Jor. & C., 1877, B. Buf. Soc., III, 142; Jor., 1878, B. U. S. G. Sur., IV, 433.

Zygonectes (*Micristius*) *brachypterus* (Cope) Jor., 1878, B. U. S. G. Sur., IV, 433; Jor. & G., 1882, B. 16 U. S. Mus., 341.

Zygonectes brachypterus Cope, 1880, B. 20 U. S. Mus., 34.

B. 6; D. 7; A. 10; V. 6; P. 12–13; Ll. 30–31; Ltr. 9; Vert. 14 + 19.

This species is distinguished from *G. Holbrookii* by a larger eye and a smaller dorsal fin. In outlines, squamation, and dentition, the two agree. The coloration of *G. patruelis* is lighter, has less of the brown, and possibly is more brilliant in life. The spots on the fins, and that below the eye, are fainter or more often absent than in *G. Holbrookii*. A faint silvery band along each flank is very common.

The eye is large, longer than the snout, two thirds of the interorbital space and two fifths to one third of the head. The normal number of dorsal rays appears to be seven, eight is rare, but frequently, especially in males, there are but six. In *G. Holbrookii* normally there are eight dorsal rays, rarely seven or nine. The variety *gracilis* does not differ in the number of fin rays, or of scales, but apparently is a trifle more slender and more uniform in coloration. Specimens from the Arkansas and from St. Louis do not differ noticeably from those secured in Texas, Louisiana, and Mississippi.

Gambusia gracilis.

Plate IV. Fig. 6, teeth.

Xiphophorus gracilis Heck., 1852, Sb. Ak. Wien, I, 300, pl. IX, fig. 3–4.
Hemixiphophorus gracilis Blk., 1860, Cypr., 480.
Gambusia Heckeli Blk., 1860, Cypr., 485.
Gambusia gracilis Gth., 1866, Cat., VI, 336; Eig., 1893, P. U. S. Mus., XVI, 57.
Heterandria nobilis B. & G., 1854, P. Phil. Ac., VI, 390.
Gambusia nobilis Grd., 1859, P. Phil. Ac., 121, — Mex. Bd. Sur., Fish., 71, pl. 39, fig. 8–11; Blk., 1860, Cypr., 485; Gth., 1866, Cat., VI, 335; Jor. & C., 1877, B. Buf. Soc., III, 142; Jor., 1878, B. U. S. G. Sur., IV, 433, — 1887, R. U. S. F. Com., 838; Jor. & G., 1882, B. 16 U. S. Mus., 346; Woolm., 1894, B. U. S. F. Com., 60.
Gambusia speciosa Grd., 1859, P. Phil. Ac., 121; Jor. & C., 1877, B. Buf. Soc., III, 142.
Zygonectes speciosa Blk., 1860, Cypr., 486.
Gambusia senilis Grd., 1859, P. Phil. Ac., 122; Trosch., 1865, Verz. Wirb. Mex., 106; Jor. & C., 1877, B. Buf. Soc., III, 142; Jor. & G., 1882, B. 16 U. S. Mus., 894; Jor., 1887, B. U. S. F. Com., 838.
Zygonectes senilis Blk., 1860, Cypr., 486; Trosch., 1865, Verz. Wirb. Mex., 106.
Gambusia nicaraguensis Gth., 1866, Cat., VI, 236, — 1868, Tr. Z. S. L., VI, 483, pl. 82, fig. 3; Gill, 1877, P. Phil. Ac., 187; Eig., 1893, P. U. S. Mus., XVI, 57.
Gambusia infans Woolm., 1894, B. U. S. F. Com., 62.

B. 6; D. 9 (sometimes 10 or 8); A. 11–10; V. 6; P. 13–14; Ll. 30–33; Ltr. 9–8; Vert. 14+17.

Female shorter and deeper than *G. Holbrookii*. Head or depth about one fourth of the length to the base of the caudal. Crown slightly convex. Snout as long as eye, broad, blunt. Eye as long as snout, two thirds of forehead, two sevenths of head. Mouth wide; lower jaws longer, firmly joined; upper short, protractile. Chin steep. Teeth conical, in bands, outer series larger. Dorsal origin little behind mid length, little backward of that of anal. Caudal short, deep, convex on hind margin. Scales, large, broad, short. The proportions in length of head or depth vary greatly in the different sizes and sexes. Usually the hook on the anal process is slight.

Brownish olive, light to dark or brown, edges of scales darker, belly lighter to silvery, lower surface of head silvery to brownish, crown dark with or without a small whitish spot. Small to medium sizes have a somewhat darker longitudinal band on the middle of the flank in which there is a dark line. On larger females the coloration is nearly uniform brown in which the band on the flank is hardly visible. Fins dusky, darker outward, or with faint transverse cloudings. Males from Monclova, Mex., have a very light ground color, dark edged scales, a blackish crown with a small but distinct white spot, a blackish vertebral line, a blackish band from the upper angle of the operculum to the middle of the tail, and a black line in the lateral band. The dark edges of the scales are blacker and wider in the band on the flanks. Mexico to Central America.

Gambusia punctata.

Plate IV. Fig. 4, teeth; Plate VIII. Fig. 6, male.

Gambusia punctata Poey, 1855, Mem., I, 384, 390, pl. 32, fig. 5-9, — 1861, Mem., II, 383, — 1868, Repert., II, 410, — 1876, An. Soc. Esp., V, 140; Blk., 1860, Cypr., 485, — 1863, Atl. Ichth., III, 140; Gth., 1866, Cat., VI, 334, — 1880, Intr., 616, fig. 280; Jor., 1878, B. U. S. G. Sur., IV, 411, — 1887, P. U. S. Mus., IX, 34, 564.

B. 6; D. 10–11 (rarely 9); A. 11; V. 6; P. 15; Ll. 30–32; Ltr. 9; Vert. 14 + 20.

Stout, much compressed behind the head; caudal pedicel deep. Head depressed, flat on the crown, about one fourth of the total length, less than the depth of the body. Snout broad, not deep, blunt, rounded, little longer than the eye. Mouth large, wide, slightly oblique — seen from the side; mandibles comparatively long, firmly united; intermaxillaries broad, protractile. Teeth in bands, conical, hooked, outer series larger. Eye large, shorter than snout, four sevenths of interorbital space, three tenths of head. Dorsal origin midway from eye to end of caudal, nearly above middle of anal. Anal originating close to middle of total length, on large specimens slightly concave on the outer margin. Caudal broad, three fourths as long as head, median rays longer, hind border convex in upper half, concave in lower, or concave in both. Males have the dorsal farther forward, while the anal is so much advanced as to lie below the end of the pectoral. The anal of this sex is small and has the second to the fourth rays elongate and otherwise modified; its length is less than one fourth of the total. Ventrals small in both sexes, below the hind half of the pectorals. Pectorals large, broad, rounded. Scales wide, short. Extended the intestine reaches the base of the tail. A female of medium size contained fifteen embryos.

Back light olivaceous, more or less greenish, with a darkish streak along the middle of the side, with a dark vertebral line, and with two to five series of dots, vittæ, along the flank behind the pectorals, formed by small spots on the base of the scale. Dorsal and caudal with transverse series of dots, more or less faint in many cases. Occiput dark, top of snout light. Black blotches are rare. Occasionally darker edges of scales form a network. Belly and lower half of head light to silvery. Usually the sides of the belly show something of the blackness of the inner lining, but not in blotches as on *G. Holbrookii* and *G. puncticulata*.

Females reach a length of two and three fourths inches, males about one and one half. In the small streams around Havana, Cuba, this species is excessively abundant.

A variety, *punctulata*, from Remedios, usually has eleven rays in the dorsal, instead of ten as in the Havana types, and the spots are more numerous and larger.

Gambusia puncticulata.

Plate VIII. Fig. 7, male.

Gambusia puncticulata Poey, 1855, Mem., I, 386, 390, pl. 31, fig. 6–7, — 1861, Mem., II, 383, — 1868, Repert., II, 410, — 1876, An. Soc. Esp., V, 140; Blk., 1860, Cypr., 485; Gth., 1866, Cat., VI, 334; Jor., 1887, P. U. S. Mus., IX, 564.

Gambusia picturada Poey, 1868, Repert., II, 410.

Gambusia picturata Poey, 1876, An. Soc. Esp., V, 141; Jor., 1887, P. U. S. Mus., IX, 564.

B. 6; D. 9 (rarely 8 or 10); A. 11; V. 6; P. 15; Ll. 29; Ltr. 9; Vert. 15 + 16.

Shaped like *G. punctata*, but differing in the number of dorsal rays and in coloration. The eye seems to be a little larger, the snout a trifle shorter, the dorsal shorter and the caudal more regularly convex on the hind margin. Instead of regular series of small spots, or vittæ, there are small spots of black on single scales scattered irregularly about. In cases these spots cover more than a single scale; rarely they appear as blotches of black large enough to cover the greater portion of the fish (*picturata*), as in *G. Holbrookii* on Plate XI. Fig. 4 and 5. Darker edges to the scales form reticulations, not always very distinct. A somewhat indefinite silvery band along the flank is present in many cases. The fins may be plain or may be thickly sprinkled with small spots, or again, dorsal and caudal may have several transverse series of black spots, sometimes fused into bands, varying in number from one to five. Belly and lower half of head silvery. A black spot, like that on *G. Holbrookii*, Plate XI. Fig. 9, 12, and 13, is present on many individuals, on the lower portion of the flank; and on many if not most an oblique spot is to be seen below the eye, a further evidence of close relationship to that species.

Inability to secure *G. puncticulata* in the fresh-water creeks where *G. punctata* was so abundant, suggests that there may be some difference in habits not yet determined. The description is taken from Poey's types, which, he says, were met with "en el foso de las murallas de la Habana."

Gambusia melanopleura.

Pœcilia melapleura Gosse, 1851, Soj. in Jam., 84, pl. 1, fig. 3; Blk., 1860, Cypr., 486.
Haplochilus melanopleurus Gth., 1866, Cat., VI, 317.
Gambusia melapleura Jor., 1887, P. U. S. Mus., IX, 564.

D. 11; A. 11; Ll. 31; Ltr. 10–9.

Gosse's figure of this species gives the shape of *G. punctata* with a more convex and regularly rounded caudal, in which the upper portion is a little the longer, and with the origin of the dorsal nearer the middle of the total length and a less distance backward of that of the anal. He gives the formula D. 11; A. 10; V. 6; P. 13; Ll. 31; Ltr. 9. "The body almost pellucid; olive above; the sides pearly, with rich amethystine reflections; green and golden hues prevail on the cheeks and gill covers; a black band, rising from the upper side of the base of the pectoral, runs along the side about one third of the length; the dorsal and caudal are edged with blackish. Length to two inches." Gunther gives a number of additional particulars.

Depth three tenths of the length to the base of the caudal; head three elevenths. Snout broad, blunt. Chin steep; lower jaw longer. Eye as long as snout, three fifths of interorbital space, one third of head. Dorsal and anal moderate. Dorsal origin midway from front of orbit to tip of tail, above sixteenth scale of lateral line, opposite the middle of the base of the anal. Free portion of tail short, depth equal to distance from dorsal. Sides of abdomen silvery; the portion above the silvery black.

Jamaica.

Gambusia episcopi.

Plate IV. Fig. 5, teeth.

Gambusia episcopi Steind., 1878, Sb. Ak., Wiss. Wien, LXXVII, extr. p. 9, pl. 2, fig. 3, 4; Eig., 1893, P. U. S. Mus., XVI, 57.

B. 6; D. 9–8; A. 10; V. 6; P. 13; Ll. 27–28; Ltr. 7–8; Vert. 14 + 16.

In form this species is not greatly different from *G. Holbrookii*. The coloration, large scales, large eye, and pointed anal fin in the females, serve as ready means to distinguish it from any others of the genus. Body compressed, head depressed, depth of body or length of head about one fourth of the total length. Snout short, not as long as eye, broad, blunt. Chin moderately steep. Mouth medium; lower jaws longer, firmly united; upper short, protractile. Teeth conical, hooked, in bands, outer series stronger and

longer. Eye large, longer than snout, three eighths of head, two thirds of forehead. Dorsal rays shorter than those of anal, origin about midway from eye to end of caudal, over the third or fourth ray of anal. Anal of the female with fourth and fifth rays prolonged in a sharp angle and the outer border concave. On younger females the angle is not so prominent. Pectoral reaching over six scales. Caudal broad, longer than head, rounded on hind margin. Scales large, twelve or thirteen between occiput and dorsal, especially wide on the flank.

Olivaceous to yellowish, edges of scales darker, crown dark, belly and lower half of head light to whitish or silvery. Six to ten short, vertical spots of darker in a series along the middle of the side, with or without spots of light color on single scales in the interspaces. A black spot on the base of the anal. Dorsal and caudal plain, or transversely clouded, the tip of the fin being dark.

The specimens described were secured along the Panama Railroad between Gorgona and Matachin.

Gambusia tridentiger sp. n.

Plate IV. Fig. 10, teeth.

B. 6 ; D. 8–7 ; A. 10 ; V. 6 ; P. 12 ; Ll. 28–30 ; Ltr. 8 ; Vert. 14 + 17.

Form similar to that of *Gambusia Holbrookii*. Head short, equal to depth of body at the anal, two ninths of the length to the base of the caudal or two elevenths of the total, slightly arched across the forehead. Snout short, not as long as the eye, narrowed and rounded forward, blunt. Mouth medium, directed obliquely upward ; lower jaws shorter than in *G. Holbrookii*, longer than the upper, firmly united ; upper short, narrow, protractile. Teeth in the outer series larger, strongly hooked, pointed, broadened somewhat toward the apex ; inner series very small, in bands, tricuspid as in Pœcilia ; pharyngeal with a shoulder. Eye large, longer than snout, one half of forehead, one third of head. Fins small, excepting the caudal. Dorsal smaller than anal and farther back, origin about midway from occiput to end of caudal, nearly above the hindmost anal ray, seventeen or eighteen scales from the head. Anal origin midway from snout to end of caudal ; it is farther forward on the male, between the ventrals, and the fin is modified to form a pointed intromittent organ about one third as long as the entire fish. Caudal deep, as long as the head, rounded on the hind margin. Scales large,

median series on the flank as wide as the eye. Intestine short. A female of an inch and a quarter contained twenty two embryos.

Light olivaceous, yellowish to brownish, with seven to ten vertical bars of brownish, separated by light or silvery spaces of equal width, on the sides of the caudal portion, edges of scales darker, centres of scales in the median series on the flank more or less silvery. Belly and lower surface of head silvery to golden. The black of the inside walls of the abdomen shows rather plainly on the outside. Occiput dark; top of snout light. A dark line between anal and caudal. Dorsal with a faint spot or group of puncticulations behind the middle near the base; other fins plain to dark tipped. Isthmus of Panama, fresh waters.

HETERANDRIA.

Heterandria Agassiz, 1853, Am. Jour. Sci., XVI, 135,—1854, Am. Jour., XVII, 365,—Tenn. Riv. Fish., 27.

Girardinus (Part) Blk., 1860, Cypr., 481; Gth., 1866, Cat., VI, 351; Jor. & G., 1882, B. 16 U. S. Mus., 348.

Shape of the body similar to that of the Funduli, compressed, rather elongate; somewhat depressed on the head. Snout short, narrow. Chin steep. Mouth small, narrow, very protractile; mandibles longer, firmly united; intermaxillaries shorter. Teeth in bands, hooked, outer series larger, firmly set, appearing slightly compressed or spear-shaped when seen from front or rear. Gill membranes short, united, free from the isthmus. Branchiostegal rays commonly five. Dorsal fin smaller and originating backward of the anal. Anal opposed to dorsal in females, greatly advanced and modified into an intromittent organ in the males. Ventrals small, more or less modified in males. Scales large. Intestine medium to elongate.

The species placed in this genus differ from those of Gambusia in the shape of the teeth, the structure of the mouth, and in the number of branchiostegal rays. Heterandria is still farther separated from Girardinus, as is seen in the structure of the mouth, the dentition, the length of the intestine, etc.

The Carolinas to the Argentine Republic.

Heterandria formosa.

Plate IV. Fig. 7, teeth; Plate VIII. Fig. 8; Plate XI. Fig. 1–3.

Heterandria formosa Agassiz, 1855, Am. Jour., XIX, 136; Grd., 1859, P. Phil. Ac., 62; Jor. & M., 1885, P. U. S. Mus., VII, 236; Jor., 1887, R. U. S. F. Com., 838; Hensh., 1891, B. U. S. F. Com., IX, 374.

Girardinus formosus Grd., 1859, P. Phil. Ac., 62; Blk., 1860, Cypr., 484; Put., 1863, B. M. C. Z., 14; Gthr., 1866, Cat., VI, 354; Jor. & C., 1877, B. Buf. Soc., III, 142; Jor., 1878, B. U. S. G. Sur., IV, 434; Goode, 1880, P. U. S. Mus., II, 119; Jor. & G., 1882, B. 16 U. S. Mus., 349.

Gambusia formosa Blk., 1860, Cypr., 485.

Hydrargyra formosa Blk., 1860, Cypr., 486.

Heterandria (= *Girardinus*) *formosa* Jor., 1885, P. U. S. Mus., VII, 323.

Heterandria ommata Jor., 1885, P. U. S. Mus., VII, 323,—1887, R. U. S. F. Com., 838; Bean, 1886, P. U. S. Mus., VIII, 555; Woolm., 1892, B. U. S. F. Com., X, 302.

Zygonectes Manni Hay, 1885, P. U. S. Mus., VIII, 555.

Rivulus ommatus Jor., 1887, P. U. S. Mus., IX, 527.

B. 5; D. 7–8; A. 10–11; V. 6; P. 12; Ll. 27–31; Ltr. 7–8; Vert. 14 + 18.

Moderately compressed, caudal pedicel moderately stout. Head flattened on the crown, about equal depth of body or one fourth of the distance from snout to base of caudal. Snout short, half as long as the eye, narrow, blunt. Mouth small, directed upward, very protractile; lower jaws longer, firmly united; upper short. Chin steep. Teeth in bands, outer series longest, slender, firmly set, slightly compressed and expanded near the acuminate point. Eye large, nearly twice the snout, once the interorbital space, or one third of the head. Dorsal fin smaller than anal. In females these fins are opposed, the former originating near the middle of the total length and slightly backward of the latter. On males, dorsal, anal, and ventrals are farther forward, the last two resting below the pectorals, while the anterior rays of the anal form a very elongate pointed intromittent organ, one third of the total length of the fish. Pectorals small. Caudal broad, rounded. Intestine about equal length of body, without head or caudal. In females of less than an inch in length the young are about ready for birth.

Olivaceous to yellowish, lighter to silver or yellow below, with an indefinitely margined band of blackish from tip of snout to caudal base along the middle of the flank, and most often with eight to fifteen vertical bars or blotches of blackish crossing the longitudinal band, which commonly ends in a black spot at the base of the tail. The vertical bars are generally interrupted on the back, but may be continuous; frequently they are less intense immediately above the dark band on the flank. Many specimens are darker on the edges of the scales. The dorsal is occasionally tipped with black; usually it has a black spot with or without white edges on its base. Most of

the females have a black spot on the anal similar to that on the dorsal. Some specimens are almost black. A specimen of one and one eighth inches is large. The Carolinas to Florida.

Heterandria minor sp. n.

Plate IV. Fig. 8, teeth.

B. 5; D. 7; A. 8; V. 6; P. 11–12; Ll. 29; Ltr. 7; Vert. 13+17.

Shape similar to that of *H. formosa.* Depth of body or length of head one fourth of the length from snout to base of caudal. Head depressed, crown flattened. Snout short, blunt, rounded, little more than half as long as eye. Chin steep. Mouth small, narrow; lower jaws firmly united, longer; upper short, very protractile. Eye large, three eighths of head, three fourths of interorbital space. Teeth in bands; outer teeth firmly set, larger, slightly compressed near the apex, or spear-shaped; inner smaller and less hooked. Intestine elongate, convolute. On females the fins are small, dorsal and anal are opposed, the former smaller and originating midway from head to base of caudal, a trifle backward of the origin of the anal; ventrals small, reaching the vent; pectorals elongate, reaching above the forward half of the ventrals; caudal as long as the head, median rays longest. On males the bases of anal and ventrals are much advanced, being below the pectorals, and greatly modified; the anal is about one third of the length of the body to the base of the caudal, its distance from the snout about equals its length, and its anterior rays form a long slender pointed organ; a couple of the outer rays of each ventral form an elongate spear-pointed process which extends along nearly half the length of the anal, resting at its side as if forming part of the intromittent organ, while the inner rays of the ventral are only about half as long as the outer, and near their ends form a projection which in cases turns downward, as if to grasp the anal and better to hold the fins together. The ventral modification appears greater in this species than in *H. formosa,* where it amounts to a simple elongation of an anterior ray in a flexible process. Females of three fourths of an inch in total length contain fully developed embryos.

Light olivaceous, probably yellowish in life, belly and lower parts of head silvery. Top of head and base of dorsal darker. Edges of scales darker. A white edged black spot on the basal half of the dorsal fin. The length of the males is about seven tenths of an inch and that of the females about eight. Villa Bella, Brazil.

HAPLOCHILINÆ.

LUCANIA.

Lucania Grd., 1859, P. Phil. Ac., 118; Blkr., 1860, Cypr., 481, — 1863, Atl. Ichth., III, 139; Gthr., 1866, Cat., VI, 309; Jor. & G., 1882, B. 16 U. S. Mus., 342.

Head and body compressed; caudal section moderately deep. Head short, crown little arched; snout short, blunt; chin steep. Mouth small, narrow. Teeth conical, in a single series in each jaw. Caudal large, other fins small. Dorsal origin near the middle of the length to the caudal, forward from that of anal. Anal fin not modified in the male. Scales large, smooth to the touch. Intestine short.

Differing from the typical Funduli in the compressed anterior half of the body, and especially in having but a single series of teeth in each jaw. The shape of the teeth is similar in the two genera.

Lucania parva.

Plate III. Fig. 5, teeth.

Cyprinodon parvus Bd., 1855, Ninth Rep., S. I., 345, extr. p. 31; Blkr., 1860, Cypr., 484; Gill, 1861, Cat. N. A. Fish, 51, — 1873, Cat. N. A. Fish, 31; Gthr., 1866, Cat., VI, 307; Jor. & C., 1877, B. Buf. Soc., III, 141; Jor., 1878, B. U. S. Geol. Surv., IV, 432.

Limia venusta Grd., 1859, Mex. Bd., Fish, 71, pl. 39, fig. 20–23.

Lucania venusta Grd., 1859, P. Phil. Ac., 118; Blkr., 1860, Cypr., 484, — 1863, Atl. Ichth., III, 139; Gthr., 1866, Cat., VI, 310; Jor. & C., 1877, B. Buf. Soc., III, 142; Jor., 1878, B. U. S. Geol. Surv., IV, 411, 432, — 1887, Rep. U. S. F. Com., 837; Jor. & G., 1882, B. 16 U. S. Mus., 343, 893, — 1883, P. U. S. Mus., V, 239, 256; Everm. & K., 1894, B. U. S. F. Com., 1892, pp. 75, 76, 83, 87, 89, 107.

Lucania affinis Grd., 1859, P. Phil. Ac., 118; Blkr., 1860, Cypr., 484; Jor. & C., 1877, B. Buf. Soc., III, 142; Jor., 1878, B. U. S. Geol. Surv., IV, 432.

Lucania parva Jor. & G., 1882, B. 16 U. S. Mus., 343, 893; Jor., 1885, P. U. S. Mus., VII, 109, — 1887, Rep. U. S. F. Com., 837; Bean, 1889, B. U. S. F. Com., VII, 129, 132, 148, pl. 2, fig. 18, — 1892, P. U. S. Mus., XIV, 92; Hensh., 1891, B. U. S. F. C., IX, 374; Smith, 1892, B. U. S. F. C., X, 68; Everm., 1893, B. U. S. F. Com., 1891, p. 87; Everm. & K., 1894, B. U. S. F. Com., 1892, pp. 83, 92, 107, pl. 25, fig. 1.

B. 6; D. 10–12; A. 10–11; V. 6; P. 14; Ll. 27–30; Ltr. 8; Vert. 14 + 14.

The arch on either back or belly is not very strong. As compared with species of Fundulus and Zygonectes the amount of compression over the body cavity and forward is quite marked. Depth about two sevenths of the length to the caudal; caudal region moderately deep. Head about one fourth of the total length, deeper than wide, flattened on the crown. Snout short, blunt, three fourths of the eye; chin steep. Mouth rather small, lower jaw longer,

symphysis firm, upper jaw protractile. Teeth subconical, strong, sharp, hooked, firmly set, in a single series in each jaw. Pharyngeal teeth stouter, with a more or less pronounced shoulder. Eye large, longer than the snout, four fifths of the interorbital space, one third of the head. Scales large, easily lost. Dorsal larger than anal, rays strong, first ray midway from front of eye to base of caudal, seventh or eighth over the first of the anal. Anal smaller, and reaching a little farther back than the dorsal. Ventrals small, bases a little in front of midway from snout to base of caudal, not reaching the anal. Pectorals moderate, tips reaching little backward of bases of ventrals. Caudal broad, subtruncate, not as long as the head. The intestine extended reaches to the base of the caudal.

Light olivaceous; edges of scales darker; darker on middle of back and toward middle of flank. Belly and lower half of head silvery. A silvery streak along the middle of the flanks. Darker across interorbital space and on occiput. Fins yellowish, or clouded with puncticulations of dark, or uniform dusky. About half of our collection shows a dark spot, edged by lighter color, at the bases of the anterior dorsal rays. Small specimens have less of the dark color, and have a more pronounced silvery band on the flank. Frequently the broad scales on the middle of the side present the appearance of vertical bars of silver. Largest individual two and one tenth inches in length.

New York to Texas.

ADINIA.

Adinia Grd., 1859, P. Phil. Ac., 117.

Body short, compressed, deep; caudal pedicel deep; head rather large, crown flat; snout short, pointed; chin steep. Mouth medium, oblique, opening upward; lower jaws longer, firmly joined; upper short, protractile. Teeth conical, outer series larger, strong, hooked. Pharyngeal teeth hooked, with a shoulder. Dorsal rather small, originating behind the middle of the body, in advance of the anal. Anal small, not modified to form an intromittent organ on the male; first ray backward of that of dorsal. Anterior rays of dorsal and anal strong, spine-like. Scales large. Intestine short.

Type *A. multifasciata* of Girard. Texas.

Adinia multifasciata.

Plate III. Fig. 3, teeth.

Adinia multifasciata Grd., 1859, P. Phil. Ac., 117, — Mex. Bd. Surv., pl. 38, fig. 12–14, said to be an immature female; Jor. & C., 1877, B. Buf. Soc., III, 142; Jor., 1878, B. U. S. G. Surv., IV, 411, 434, — 1887, Rep. U. S. F. Com., 836.

Gambusia multifasciata Blkr., 1860, Cypr., 485.

Fundulus (*Adinia*) *xenicus* Jor. & G., 1882, B. 16 U. S. Mus., 892.

Fundulus xenicus G. & B., 1883, P. U. S. Mus., V, 239; Jor. & G., 1883, P. U. S. Mus., V, 255; Everm., 1893, B. U. S. F. Com., 1891, p. 85.

B. 5; D. 9–10; A. 11; V. 6; P. 12–14; Ll. 25–27; Ltr. 8–9; Vert. 12 + 16.

Body short, much compressed, deep, considerably arched on the back. Head narrow below, broader and flattened on the crown, length equal depth of body, or one third of the length from snout to caudal. Snout short, narrow, somewhat pointed. Mouth medium, narrow, lower jaw longer, upper very protractile. Teeth conical, hooked, outer series larger, in open order; pharyngeal few in number, hooked, bearing a shoulder. Eye large, one third of head, three fourths of interorbital space. Dorsal origin half way from the middle of the eye to the base of the caudal; rays strong, spinelike, fourth or fifth above the first of the anal. Intestine short.

Light olivaceous, silvery below, brown on top of head; with about nine silvery bands across the flank, more distinct toward the tail; a darker band across the bases of the caudal rays. On young specimens the sides are more silvery and the bands more distinct and numerous.

This species differs from the other Funduli in the greater compression of the body and the stronger dorsal rays. The individual described had a length of one and three eighths inches.

Texas.

FUNDULUS.

Fundulus LaC., 1803, Poiss., V, pp. xx, 37; Cuv., 1829, R. An., II, 280, — 1836, R. An., I, 533; Val., 1828, Humb. Obs. Zool., II, 160, 162, — 1846, C. V. Poiss., XVIII, 178; Wagn, 1828, Isis, XXI, 1056; Schinz, 1836, Nat. u. Abbild., 217; M'Clell., 1839, As. Res., XIX (2), 424; Swains, 1839, Class., II, 311; DeK., 1842, N. Y. Fish., 216; Blkr., 1860, Cypr., 483, — 1863, Atl., III, 140; Gill, 1861, N. A. Fish, 52, — 1865, Can. Nat., extr. p. 16; Gthr., 1866, Cat., VI, 318, — 1880, Intr., 615; Stor., 1867, Mass. Fish, 127; Jor. & G., 1882, B. 16 U. S. Mus., 331; Seeley, 1886, Fish. Eur., pp. 22, 371. *Fondule* Guer., 1838, Icon. Poiss., 29; Dum., 1856, Ichth., 411, 440. *Fundulinæ* Gill, 1894, Mem. Acad., VI, 133. *Hydrargira* LaC., 1803, Poiss., V, 378; Les., 1817, Jour. Phil. Ac., I, 126; Stor., 1839, Mass. Fish., 93. *Hydrargyra* Stor., 1846, Syn., 180, — Mem. Am. Ac., II, 432, — 1867, Mass. Fish, 131; Poey, 1855, Mem., I, 382; Blkr., 1860, Cypr., 483, — 1863, Atl., III, 140; Gill, 1865, Can. Nat., ex. p. 16; Jor. & G., 1882, B. 16 U. S. Mus., 331. *Hydrargyrinæ*, Gill, 1861, N. A. Fish, 51, — 1865, Can. Nat. *Hydrargyre* Dum., 1856, Ichth., 411, 441. *Pœcilia* Stor., 1846, Synops., 178, — Mem. Am. Ac., II, 430. *Xenisma* Jor. & C., 1877, B. Buf. Soc., III, 142; Jor. & B., 1878, B. 12 U. S. Mus., 48, 62, 77; Jor., 1878, B. U. S. G. Surv., IV, 411, 433, — 1889, P. U. S. Mus., XI, 356; Jor. & G., 1882, B. 16 U. S. Mus., 336.

More or less depressed forward, compressed posteriorly; head broadened; snout blunt; caudal fin and pedicel deep. Mouth developed laterally and horizontally; lower jaws longer, firmly united, upper protractile. Teeth conical, in bands, larger in the outer series. Branchiostegal rays five to six. Pharyngeal teeth with a hook and a shoulder, some to many, according to the species, enlarging and becoming molars with age. Gill openings wide; membranes united, free from the isthmus. Dorsal and anal behind the middle of the body, opposed, the former commonly larger and originating a little farther forward than the latter. Anal not modified into an intromittent organ in the male, but generally, as other fins, a trifle larger in that sex. Intestine rarely long.

This genus is subdivided into four or five subgenera: *Fundulus*, with the type *F. heteroclitus*, *Hydrargyra*, of which the typical species is *F. majalis*, *Xenisma*, containing *F. catenatus* and its closer allies, *Plancterus*, based upon *F. Kansæ*, and possibly a fifth for trans-Atlantic species, of which *F. hispanicus* is best known.

North and Central America; Southern Europe; Africa.

Fundulus grandis.

Fundulus grandis B. & G., 1853, P. Phil. Ac., VI, 389; Grd., 1859, Mex. Bd. Fishes, 69, pl. 36; Blkr., 1860, Cypr., 487; Jor. & C., 1877, B. Buf. Soc., III, 141; Jor. 1878, B. U. S. G. Surv., IV, 433; G. & B., 1880, P. U. S. Mus., II, 151, — 1883, P. U. S. Mus., 239; Jor. & G., 1882, B. 16 U. S. Mus., 891, — 1883, P. U. S. Mus., V, 253.

Fundulus floridensis Grd., 1859, P. Phil. Ac., 157; Blkr., 1860, Cypr., 487; Goode, 1880, P. U. S. Mus., II, 118.

Fundulus spilotus Put., 1864, B. M. C. Z., ex. p. 13.

Fundulus ocellaris Jor. & G., 1882, B. 16 U. S. Mus., 891; G. & B., 1883, P. U. S. Mus., V, 239; Jor. & G., 1883, P. U. S. Mus., V, 254, 306; Jor., 1885, P. U. S. Mus., VII, 319, — 1887, R. U. S. F. Com., 837; Hensh., 1891, B. U. S. F. Com., IX, 374; Woolm., 1892, B. U. S. F. C., X, 300, pl. 52, fig. 2.

Fundulus heteroclitus grandis Jor. & G., 1883, P. U. S. Mus., 586; Jor. & S., 1885, P. U. S. Mus., VII, 230; Jor., 1887, R. U. S. F. C., 837; Everm. & K., 1894, B. U. S. F. Com., 1892, pp. 66, 75, 79, 83, 87, 89, 92, 106.

Fundulus heteroclitus Gthr., 1866, Cat., VI, 318 (part); Jor., 1885, P. U. S. Mus., VII, 109.

Fundulus confluentus Goode, 1880, P. U. S. Mus., II, 118; Jor. & G., 1882, B. 16 U. S. Mus., 334; Jor., 1887, R. U. S. F. Com., 837.

Fundulus pallidus Everm., 1893, B. U. S. F. Com., 1891, p. 84, pl. 35, fig. 2; Everm. & K., 1894, B. U. S. F. Com., 1892, pp. 83, 87, 89, 90, 92, 106, pl. 23, fig. 1.

Zygonectes pulvereus Everm., 1893, B. U. S. F. Com., 1891, p. 85, pl. 36, fig. 1; Everm. & K., 1894, l. c., 1892, pp. 83, 87, 89, 92, 107, pl. 24, fig. 2.

Zygonectes funduloides Everm., 1893, B. U. S. F. Com., 1891, p. 85, pl. 35, fig. 3; Everm. & K., 1894, l. c., 1892, pp. 83, etc., pl. 24, fig. 1.

B. 5; D. 11; A. 10–11; V. 6; P. 15–17; Ll. 33–36; Ltr. 13; Vert. 15 + 18.

Shape resembling that of *F. heteroclitus*. Stout, much compressed, head

subquadrate in transsection, caudal and pedicel deep. Young are more rounded and have not so much of massiveness in the snout. On large ones the head is one third or more of the length to the caudal base. Snout broad, blunt, rounded, one half longer than the eye. In a five inch specimen the eye is two thirds of the snout, one half of the interorbital space, and one fifth of the head. Mouth wide, lower jaw longer, upper protractile. Teeth conical, in bands, outer series larger; pharyngeal as in *F. heteroclitus*. Chin steep. Dorsal origin little behind the middle of the total length, little in front of that of anal. Pectorals reaching a vertical from base of ventrals. Caudal deep, two thirds as long as head, rounded to subtruncate, sometimes oblique, by reason of the lower half being longer. Oviduct apparently not adherent to anal so long a distance as in *F. heteroclitus*.

Most large individuals from the salt water are brownish with faint spots of brown, thickly freckled with small spots of white or silver. The fins vary from dark to light, more or less spotted with brown and with light color. The ocellate spot of dorsal or of anal becomes indistinct or obsolete. Top of head and back dark; cheeks dark, sometimes bronzed. In cases that retain the ocellus the dorsal may have several transverse series of light spots. Anal uniform or spotted. Caudal marked with irregular transverse series of small spots to uniform. A whitish margin to dorsal, caudal and anal is not rare. Medium sizes from the sea have more of the silver color on the flank, in cases arranged in narrow vertical bands.

Young individuals from fresh water are rusty brownish, with little of the silver, with numerous scattered small spots of brown, in cases forming longitudinal series, in others vertical bands. Lower surfaces lighter, whitish under the head. A black spot on the hinder rays of the dorsal is commonly present; occasionally a similar one is found on the anal. Generally these spots are edged by white. The spots along the middle of the side are usually larger. The tail is spotted but rarely; generally the fins are nearly uniform light colored. Reaches six inches or more in length.

Florida to Texas.

Fundulus heteroclitus.

Plate II. Fig. 2, teeth; Plate VIII. Fig. 1, female.

Cobitis heteroclita Linn., 1766, Syst., I, 500; Müll., 1774, Nat. Syst., IV, 285; Neuer Schauplatz der Natur, 1775, I, 284; Bor., 1784, Nat. Abb. Fische, 125; Schoepff, 1788, Schr. Ges. N. Fr., VIII, 171, 172 (*Killfish*, and *Yellow-bellied Cobler*); Gmel., 1789, Syst., I, 1352; Walb., 1792, Art. Gen. Pisc., 11; Donnd., 1798, Beytr., III, 581; Turt., 1806, Syst. Nat., I, 837.

Cobitis macrolepidota Walb., 1792, Art. Gen. Pisc., 11; Donnd., 1798, Beytr., III, 582.

Pœcilia fasciata Bl., 1801, Schn. Syst. Ichth., 453.

Fundulus fasciatus Val., 1828, Humb. Obs. Zool., II, 162, pl. 52, fig. 1, 4, 5; Wagn., 1828, Isis, XXI, 1056; Rich., 1837, Rep. 6 Brit. Assoc., 213; Guer., 1838, Icon., 29; DeK., 1842, N. Y. Fish, 216, pl. 31, fig. 98; Knight, 1866, N. S. Fishes, 26.

Hydrargyra fasciata Ayres, 1843, J. B. N. H. Soc., IV, 266; Stor., 1846, Syn., 180, — Mem. Am. Ac., II, 432.

Pœcilia cœnicola Bl. Sch., 1801, Syst., pp. lii, 452.

Fundulus cœnicolus Val., 1828, Humb. Obs. Zool., 162, — 1846, C. V. Poiss., XVIII, 179, pl. 530; Wagn., 1828, Isis, XXI, 1056; Rich., 1837, Rep. 6 Brit. Assoc., 213; Blkr., 1860, Cypr., 486.

Hydrargira swampina LaC., 1803, Poiss., V, 379, pl. 10, fig. 3; Val., 1846, C. V. Poiss., XVIII, 203; Blkr., 1860, Cypr., 486, — 1863, Atl., III, 140; Gill, 1861, N. A. Fish, 51, — 1873, N. A. Fish, 31; Yarr., 1877, P. Phil. Ac., 214; Jor. & C., 1877, B. Buf. Soc., III, 141; Jor., 1878, B. U. S. G. Surv., IV, 411, 433; Jor. & G., 1879, P. U. S. Mus., I, 384; Goode, 1880, P. U. S. Mus., II, 118.

Pœcilia (*Hydrargyra*) *swampina* Goldf., 1820, Handb. Zool., II, 16.

Fundulus (*Hydrargyra*) *swampinus* Jor. & G., 1882, B. 16 U. S. Mus., 331, 332.

Fundulus mudfish LaC., 1803, Poiss., V, 37, 38; Blkr., 1863, Atl., III, 140.

Esox pisciculus Mtch., 1815, Tr. Lit. Phil. Soc., I, 440.

Esox pisculentus Mtch., 1815, Tr. Lit. & Phil. Soc. N. Y., I, 441.

Hydrargyra pisculenta Ayr., 1843, J. B. N. H. S., IV, 267; Lins., 1844, Am. Jour., XLVII, 68; Stor., 1846, Syn., 180, — Mem. Am. Ac., II, 432.

Fundulus pisculentus Stor., 1855, Mem. Am. Ac., V, 294, pl. 23, fig. 3, 4, — 1867, Mass. Fish., 128, pl. 23, fig. 3, 4; Blkr., 1860, Cypr., 486; Gill, 1861, N. A. Fish, 52, — 1873, N. A. Fish, 31, — 1865, Can. Nat., extr. p. 16; Holm., 1862, Sec. Rep. Me., 32; Put., 1863, B. M. C. Z., 13; Gthr., 1866, Cat., VI, 324; Yarr., 1877, P. Phil. Ac., 214; Jor. & C., 1877, B. Buf. Soc., III, 141; Jor., 1878, B. U. S. G. Sur., IV, 433, — 1878, Man. Vert., 263; G. & B., 1879, B. Essex Inst., XI, ext. p. 22; Bean, 1881, P. U. S. Mus., III, 104.

Esox zonatus Mtch., 1815, Tr. Lit. & Phil. Soc. N. Y., I, 443.

Hydrargira ornata Les., 1817, J. Phil. Ac., I, 131; Rich., 1837, Rep. 6 Brit. Assoc., 213; DeK., 1842, N. Y. Fish, 221; Lins., 1844, Am. Jour., XLVII, 68; Stor., 1837, J. B. N. H. S., I, 131, — 1839, Mass. Fish, 94, — 1846, Syn., 181, — Mem. Am. Ac., II, 433, — 1857, J. B. N. H. Soc., VI, 264.

Hydrargira nigrofasciata Les., 1817, J. Phil. Ac., I, 133; Rich., 1837, Rep. 6 Brit. Assoc., 213; Stor., 1839, R. Mass. Fish, 94, — 1846, Syn., 182, — Mem. Am. Ac., II, 434; DeK., 1842, N. Y. Fish, 221; Lins., 1844, Am. Jour., XLVII, 67.

Fundulus nigrofasciatus Val., 1846, C. V. Poiss., XVIII, 193; Blkr., 1860, Cypr., 486; Gthr., 1866, Cat., VI, 325; Stor., 1867, Mass. Fish, 129, pl. 23, fig. 1; Gill, 1873, N. A. Fish, 31; Jor. & C., 1877, B. Buf. Soc., III, 141; Jor., 1878, B. U. S. G. Sur., IV, 433, — 1878, Man. Vert., 263; G. & B., 1879, B. Essex Inst., ext. p. 22; Ag., 1882, P. Am. Ac., XVII, 297, pl. 19–20; Jor. & G., 1882, B. 16 U. S. Mus., 335; Gthr., 1889, Pelagic Fishes, 33.

Fundulus zebra DeK., 1840, N. Y. G. Sur., 29, — 1842, N. Y. Fish, 218; Bd., 1855, Ninth Rep. S. I., 28; Gill, 1856, Smithson. Rep., 264.

Fundulus flavidus DeK., 1840, N. Y. G. Sur., 29.

Fundulus viridescens DeK., 1842, N. Y. Fish, 217, pl. 31, fig. 99; Gill, 1856, Smithson. Rep., 264.

Fundulus fonticola Val., 1846, C. V. Poiss., XVIII, 198; Blkr., 1860, Cypr., 486; Jor., 1887, P. U. S. Mus., 526, 564.

Fundulus heteroclitus Gill, 1861, N. A. Fish, 52, — 1873, N. A. Fish, 31; Put., 1863, B. M. C. Z., 13; Gthr., 1866, Cat., VI, 318; Jor. & C., 1877, B. Buf. Soc., III, 141; Jor., 1878, B. U. S. G. Sur., 411, 433, — 1885, P. U. S. Mus., VII, 322, — 1887, P. U. S. Mus., IX, 26, — R. U. S. F. Com., 837; Jor. & G., 1879, P. U. S. Mus., I, 384, — 1882, B. 16 U. S. Mus., 336, — 1883, P. U. S. Mus., V, 585, — 1887, P. U. S. Mus., IX, 26; Goode, 1880, P. U. S. Mus., II, 118; Bean, 1881, P. U. S. Mus., III, 104, — 1889, B. U. S. F. Com., VII, 132, 148; G. & B., 1886, P. U. S. Mus., VIII, 204; Ryd., 1887, J. R. M. Soc. Lond., (2) VI, 941; Gilb., 1890, B. U. S. F. Com., VIII, 227; Hensh., 1891, B. U. S. F. Com., IX, 374; Smith, 1892, B. U. S. F. Com., X, 66, pl. 19, fig. 4; Boyer, 1892, Bull. Mus. Comp. Zool., XXIII, 91, pl. 1–8; Everm., 1893, B. U. S. F. Com., 1891, 84.

Fundulus Bermudæ Gthr., 1874, Ann. Mag. N. H., (4) XIV, 370, — 1880, Chall. Shore Fishes, 10, pl. 32, fig. B; Goode, 1876, Berm. Fish, 68, — B. U. S. Mus.; Jor., 1887, P. U. S. Mus., IX, 564.

Fundulus rhizophoræ Goode, 1877, Am. Jour., 298.

Fundulus heteroclitus grandis Bean, 1892, P. U. S. Mus., XIV, 92.

B. 5 (rarely 6); D. 11–13; A. 10–12; V. 6; P. 17–19; Vert. 14–15 + 19–20.

Moderately stout, compressed posteriorly, depressed on the head; arch from head to dorsal rather low; depth in front of dorsal equal length of head, or one half more than depth of caudal pedicel. Head two sevenths of the length to the base of the caudal, as broad as deep, flattened on the crown. Snout as long as eye, blunt, rounded; chin convex, moderately steep. Mouth nearly twice as wide as eye. Teeth conical, in bands, outer series larger; pharyngeal with a shoulder, some of the median larger, compressed, swollen. Eye medium, once in snout, twice in interorbital space, four and a half times in the head. Cheek scales in three rows below the orbit. Dorsal and anal little behind the middle of the total length; dorsal origin midway from head to base of caudal; fin not reaching as far backward as the anal. Base of anal opposed to that of dorsal, hardly reaching as far either forward or backward as that of dorsal. Fins comparatively large and broad, varying with age and sex. Caudal deep, subtruncate to rounded. Pectorals wide, short, rounded, reaching a vertical from the bases of the ventrals. Scales large, striate. Oviduct adherent for some distance along the first ray of the anal. Intestine as long as the fish. A few individuals have six branchiostegal rays instead of five.

Males are most often olivaceous, darker on the back, lighter to white or silvery beneath, with a dozen or more narrow vertical bars of light color across the flanks, and with a black spot edged with white on the hind rays of the dorsal. Fins and body are more or less marked with small spots, bars, or dots of dark and of light colors. A black spot sometimes present on the hind rays of the anal; and not rarely the hind margins of dorsal, anal, and caudal are whitish. On some individuals of this sex the colors are more like those of the females. Southward the silvery spots and dots are more distinct on body and fins. As in the salmon and trout the silver color is more prevalent in salt-water specimens, and no doubt fresh-water examples change on entering the sea.

Females are not so brightly colored as males; some are nearly uniform brownish on the backs, lighter below, with a darker spot on each scale; others have vertical bars or spots of brownish on the flanks. The vertical silvery streaks are frequently met with, but less distinct. In cases a silvery tint extends the length of the body on the middle of the side. The spot on the dorsal is rarely present on the female. Generally the lower half of the

opercle is silvery, and across the upper edge there is a darker streak. The largest male at hand is four and three fourths inches in length; the largest female five and three fourths.

Of this species there are several varieties beside the typical *heterocli'tus*: *Bermudæ* from the Bermudas, *badius* from Grand Menan, and *pisculentus* of the coasts of New England.

Eastern coasts of the United States and Canada to Bermuda.

Fundulus parvipinnis.

Plate II. Fig. 3, 4, teeth.

Fundulus parvipinnis Grd., 1854, P. Phil. Ac., VII, 154, — 1859, P. R. R. Rep., X, Fish, 303; Blkr., 1860, Cypr., 487; Gthr., 1866, Cat., VI, 319; St., 1876, Sb. Ak. Wien, LXXIV, ext. 153, pl. 10, fig. 1–2; Jor. & C., 1877, B. Buf. Soc., III, 141; Jor., 1878, B. U. S. G. Sur., IV, 433; Smith, 1880, List Fish San Diego, — 1884, P. U. S. Mus., VI, 233, — 1885, W. Am. Sci., 54; Bean, 1881, P. U. S. Mus., III, 105; Jor. & G., 1881, P. U. S. Mus., III, 30, 457, — 1882, P. U. S. Mus., IV, 42, — 1883, P. U. S. Mus., V, 355; Jor. & J., 1882, P. U. S. Mus., IV, 13; Eig., 1892, Ann. Lyc. N. Y., VI, 352, — P. U. S. Mus., XV, 142.

Fundulus (*Hydrargyra*) *parvipinnis* Jor. & G., 1882, B. 16, U. S. Mus., 333; Jor., 1887, R. U. S. F. Com., 836.

Fundulus punctatus Gthr., 1866, Cat., VI, 320, — 1868, Tr. Z. Soc., VI, 482, pl. 84, fig. 5; Jor., 1886, P. U. S. Mus., VIII, 368; Eig., 1893, P. U. S. Mus., XVI, 56.

Fundulus guatemalensis Gthr., 1866, Cat., VI, 321, — 1868, Tr. Z. Soc., VI, 482, pl. 84, fig. 3–4; Jor., 1886, P. U. S. Mus., VIII, 368; Eig., 1891, P. U. S. Mus., XIV, 64, — 1893, P. U. S. Mus., XVI, 56.

Fundulus pachycephalus Gthr., 1866, Cat., VI, 321, — 1868, Tr. Z. Soc., VI, 483, pl. 84, fig. 6; Jor., 1886, P. U. S. Mus., VIII, 368; Eig., 1893, P. U. S. Mus., XVI, 56.

Fundulus vinctus Jor. & G., 1882, P. U. S. Mus., V, 355; Jor., 1886, P. U. S. Mus., VIII, 368, — 1887, R. U. S. F. Com., 837.

Fundulus lima Vaill., 1894, Bull. Soc. Philom., (8) VI, 71.

Var. **labialis.**

Fundulus labialis Gthr., 1866, Cat., VI, 319, — 1868, Tr. Z. Soc., VI, 481, pl. 84, fig. 1, 2; Eig., 1893, P. U. S. Mus., XVI, 56.

Fundulus robustus Bean, 1892, P. U. S. Mus., XV, 285, pl. 44, fig. 2.

B. 5; D. 13–15; A. 12–16; V. 6; P. 18–20; Ll. 34–36; Ltr. 12–14; Vert. 15 + 19.

From the side this fish bears some resemblance to *F. heteroclitus*: but the head is smaller, and seen from above head and shoulders are more compressed. Head somewhat narrow and pointed, about one fourth of the total length, or a little more than the depth of the body; crown flattened. Snout comparatively narrow, blunt, as long as the eye. Mouth medium, lower jaw longer, upper protractile. Teeth conical, hooked, in bands, outer series larger; pharyngeal with a shoulder, median swollen and molar-like. Eye large, as long as snout, one fourth of the head, two thirds to three fifths of the interorbital space. Dorsal origin near the middle of the total length, a

little farther forward than that of the anal. Anal base shorter than that of dorsal, opposed, fin rays more often longer and reaching farther back. On large males the anal becomes long, pointed on the lower angle and concave on the outer (hinder) margin. Both dorsal and anal vary greatly with age and sex. Ventrals small, not reaching the anal. Pectorals small, short, broad. Caudal broad, two thirds the length of the head, subtruncate. All fins longer on males. Oviduct produced but little on the first ray of the anal, a prominent flap at each side of the bases of the anterior rays. If straightened the intestine would reach to the end of the caudal.

Olivaceous, puncticulate with brown. Old males become very dark on the upper surfaces. A more or less distinct band of brown along the flanks, fading anteriorly. With or without numerous vertical bars on the flank; in some cases each bar is broken into three, forming three longitudinal series of spots. Scales commonly darker on their edges. A silvery tint along the sides is not rare. Cheeks and belly with a metallic lustre. Some of the males are very dark, have the dorsal and anal fins considerably elongated, and the borders of these fins light colored, while the middle is crossed by cloudings or a band of black puncticulation. Largest specimen three and three fourths inches in length.

California and southward.

Var. *labialis* has the same coloration, but seems to possess a few more scales and fin rays. The variability of the species is so great, however, that these features are hardly sufficient to distinguish it.

Guatemala.

Fundulus adinius.

Plate II. Fig. 8, teeth.

Hydrargyra zebra Grd., 1859, P. Phil. Ac., 60; Blkr., 1860, Cypr., 486.

Fundulus zebra Gthr., 1866, Cat., VI, 324; Jor. & C., 1877, B. Buf. Soc., III, 141; Jor., 1878, B. U. S. G. Surv., IV, 433, 664.

Fundulus (*Hydrargyra*) *zebra* Jor. & G., 1882, B. 16 U. S. Mus., 333.

Fundulus adinia Jor. & G., 1882, B. 16 U. S. Mus., 335; G. & B., 1883, P. U. S. Mus., V, 239; Jor., 1887, Rep. U. S. F. Com., 837.

Fundulus zebrinus Jor. & G., 1882, B. 16, U. S. Mus., 891; Everm. & K., 1894, B. U. S. F. Com., 1892, 76, 77, 83, 89, 92, 106.

Fundulus extensus Jor. & G., 1883, P. U. S. Mus., V, 355; Jor., 1886, P. U. S. Mus., VIII, 368,—1887, R. U. S. F. Com., 837.

Fundulus diaphanus Cope, 1880, B. 20, U. S. Mus., 33; Everm. & K., 1894, B. U. S. F. Com., 1892, 83, 90, 92, 106, pl. 23, fig. 3, 4.

Fundulus ? *multifasciatus* Cope & Y., 1875, Wheel. Exp. Zool., V, 695.

B. 5; D. 14; A. 14; V. 6; P. 17; Ll. 48; Ltr. 15; Vert. 15+18.

Form rather stouter than that of *F. diaphanus*, and somewhat more compressed. Depth, or length of head, three elevenths of the length to the caudal. Head narrow forward, crown slightly convex. Snout nearly twice as long as the eye, blunt. Eye almost twice in snout, about one fifth of head, one half of forehead across the eyes. Mouth medium, oblique, with considerable lateral development. Teeth conical, in bands, outer series larger, hooked. Origin of dorsal midway between front of eye and tip of tail, or midway between head and base of caudal. Anal origin a little farther back than that of dorsal, tip of fin reaching nearer the caudal; oviduct extended upon the anterior ray; ventrals short, not reaching anal. Pectorals not reaching bases of ventrals. Caudal medium, subtruncate. Scales smaller than those of *F. diaphanus*, harsh.

Ashy brown or grayish, lower surfaces silvery, upper brown. With about sixteen narrow bands of brown across the sides, and one or more fainter ones across the caudal. A dark streak on the operculum, behind the eye. A dark spot at the origin of the dorsal.

Fort Defiance, New Mexico.

Fundulus diaphanus.

Plate II. Fig. 7, teeth.

Hydrargira diaphana Les., 1817, J. Phil. Ac., I, 130; DeK., 1840, G. Surv. N. Y., extr. p. 29, — 1842, N. Y. Fish, 219. *Hydrargyra diaphana* Rich., 1837, Rep. 6 Brit. Assoc., 213; Stor., 1846, Syn., 181, — Mem. Am. Ac., II, 433.

Hydrargira multifasciata Les., 1817, J. Phil. Ac., I, 131; DeK., 1840, N. Y. G. Surv., 29, — 1842, N. Y. Fish, 220. *Hydrargyra multifasciata* Rich., 1837, Rep. 6 Brit. Assoc., 213; Stor, 1846, Syn., 181, — Mem. Am. Ac., II, 433.

Fundulus diaphanus Bd., 1855, Ninth Rep. S. I., extr. p. 29; Gill, 1861, N. A. Fish, 52; Nels., 1876, B. I. Lab., I, No. 1, 42; Jor. & C., 1877, B. Buf. Soc., III, 141; Jor., 1878, B. U. S. G. Surv., IV, 433, — B. 2 I. Lab., 51, — 1887, R. U. S. F. Com., 837; Forb., 1878, B. I. Lab., I, No. 2, 78, 85, — 1883, No. 6, 71, 93; Cope, 1880, B. 20 U. S. Mus., 32; Jor. & G., 1882, B. 16 U. S. Mus., 334; Bean, 1884, P. U. S. Mus., VI, 366, — 1889, B. U. S. F. Com., VII, 132, 148, — 1892, P. U. S. Mus., XIV, 92; Crag., 1885, B. Wash. Lab., I, 110; Meek, 1889, Ann. N. Y. Lyc., IV, 310; McC., 1892, B. 2 Ob. Coll. Lab., 23; Smith, 1892, B. U. S. F. Com., X, 65, pl. 19, fig. 2–3.

Fundulus multifasciatus Val., 1846, C. V. Poiss., XVIII, 200; Bd., 1855, Ninth Rep. S. I, extr. p. 30, — 1873, R. U. S. F. Com., I, 826; Blkr., 1860, Cypr., 486; Gill, 1861, N. A. Fish, 52, — 1873, N. A. Fish, 31; Put., 1863, B. M. C. Z., 7; Cope, 1865, P. Phil. Ac., 78; Gthr., 1866, Cat., VI, 324; Stor., 1867, Mass. Fish, 130, pl. 23, fig. 2; Jor., 1874, Ind. Fish, 32, — 1878, B 2 I. Lab., 52; G. & B., 1879, B. Ess. Inst., XI, extr. p. 22.

Fundulus pisculentus Val., 1846, C. V. Poiss., XVIII, 190.

Hydrargyra swampina Val., 1846, C. V. Poiss., XVIII, 203.

Fundulus swampinus Gthr., 1866, Cat., VI, 323.

Fundulus (*Hydrargyra*) *swampina* Jor. & G., 1882, B. 16 U. S. Mus., 332.

Fundulus menona Jor., 1877, P. Phil. Ac., 68, — 1878, Man. Vert., 263, — B. U. S. G. Surv., IV, 433; Jor. & G., 1882, B. 16 U. S. Mus., 335.

Fundulus diaphanus menona Everm. & J., 1889, P. U. S. Mus., XI, 55; Boll., 1890, B. U. S. F. Com., VIII, 223; Eig., 1894, R. Ind. Biol. Surv., 94.

B. 6; D. 14 (13–15); A. 12–11; V. 6; P. 16–17; Ll. 41–48; Ltr. 15 (14–16); Vert. 17 + 18.

Form more elongate than that of either *F. heteroclitus* or *F. majalis*, outline of back straighter, body less compressed. Shape of head intermediate between these species, length less than depth of body, three and one half times in the distance from snout to caudal; crown flattened. Snout medium, little longer than the eye. Mouth moderate; lower jaw longer, not so much turned upward as in *F. majalis*, symphysis firm; upper shorter, protractile. Eye large, less than one and one half times in the interorbital space, about two sevenths of head. Teeth conical; outer series larger, hooked; pharyngeal with a shoulder, some of the median resembling molars. Origin of dorsal a little in front of midway from snout to tip of caudal, nearly half of the base of the fin being forward of the anal. Oviduct of females not much prolonged upon the first anal ray, but appearing rather as if a fold at each side of its base. Caudal pedicel moderately slender; fin not as long as head, truncate.

Olive brown to very light and translucent, darker on the back, lighter below; with numerous narrow vertical bars of brown on the flanks, separated by spaces silvery to yellowish or pinkish. The bars are variable in number, size, and distinctness; on some the brown is most extensive and the light color is reduced to narrow streaks; on others the silver has taken the place of the brown to a great extent. Translucent or very light colored specimens are not very rare, the condition being in some cases individual and in others perhaps induced by the character of the water. An occasional one has black specks scattered over the entire body; these seem more noticeable where the bands are obsolescent. The brown is made up of puncticulations; exceptionally these are ranged around the edges of the scales. Reaches a length of three and a half inches or more.

Maine to the Mississippi Valley inclusive, and southward to the Carolinas.

Fundulus Kansæ.

Plate II. Fig. 10, teeth.

Fundulus zebrinus Gilb., 1884, B. Wash. Lab., I, 15, — 1889, B. 9 Wash. Lab., 39, 40; Crag., 1885, B. Wash. Lab., I, 110; Everm. & F., 1885, P. Phil. Ac., 412; Jor., 1885, Rep. U. S. F. Com., 48, — 1887, R. U. S. F. Com., 836, — 1891, B. U. S. F. Com., IX, 17; Hay, 1888, P. U. S. Mus., X, 249, 250, 252; Everm. & K., 1894, B. U. S. F. Com., 1892, pl. 23, fig. 2.

B. 5; D. 15–17; A. 13–15; P. 16–17; Ll. 60–65; Ltr. 18–20; Vert. 15 + 21.

Head depressed, body compressed, depth equal length of caudal or two elevenths of the total. Head as wide as deep, subquadrate in transsection, one fourth of the total length, three tenths of the length without the caudal; crown broad, flat to concave in front of the orbits. Snout blunt, large, wide and long, twice as long as the eye, slightly turned upward at the mouth. Mouth wide. Teeth conical, slender, hooked; outer series larger, in open order; pharyngeal groups much reduced in size, shoulders present or absent. Eye rather large, twice in snout, twice in forehead; two elevenths times in head. Scales small, harsh. Intestine one and one half times the total length of the fish. Dorsal originating in the middle of the total length, longer in base and shorter in rays than anal. Anal origin a little farther back than that of dorsal, oviduct extending a short distance on first ray. Ventrals small, reaching anal. Pectorals medium, reaching bases of ventrals. Caudal large, deep, subtruncate. Peritoneum black. Largest specimen three and three fourths inches in length.

Back brownish olive, belly silvery white. Flanks crossed by twelve to twenty-two bands of brown separated by silvery, varying from mere streaks to bands broader than the interspaces. In such cases as have wide bands these may posteriorly cross the lower surface. The convolutions of the intestine and the reduction of the pharyngeals indicate habits differing from those of the majority of the genus. This is not the species to which the name zebrinus was first applied.

Kansas.

Fundulus majalis.

Plate II. Fig. 5–6, teeth; Plate IX.

Mayfish Schoepff, 1788, Schr. Ges. N. Fr., VIII, 173.

Cobitis majalis Walb., 1792, Art. Gen. Pisc., 12; Donnd., 1798, Beytr., III, 582.

Pœcilia majalis Bl. Schn., 1801, Syst., pp. lii, 453.

Esox flavulus Mtch., 1815, Tr. L. & P. Soc. N. Y., I, 439.

Cyprinodon flavulus Val., 1828, Humb. Obs. Zool., II, 164, pl. 52, fig. 3, 6, 7; Wagn., 1828, Isis, XXI, 1056; Guer., 1838, Icon., 29, pl. 48, fig. 3; Rich., 1837, R. 6 Brit. Assoc., 213; Val., 1840, R. An. Ill., Poiss., 229, pl. 95, fig. 5.

Hydrargyra flavula Stor., 1839, Mass. Fish, 95, — 1846, Syn., 180, — Mem. Am. Ac., II, 432, — 1855, Mem. Am. Ac., V, 294, pl. 23, fig. 5–6, — 1867, Mass. Fish, 131, pl. 23, fig. 5–6; Ayr., 1843, J. B. N. H. S., IV, 267; Lins., 1844, Am. Jour., XLVII, 68; Bd., 1855, Ninth Rep. S. Inst., ext. p. 30; Gill, 1856, Rep. S. Inst., 264.

Hydrargyra formosa Stor., 1837, P. B. N. H. S., I, 76.

Hydrargyra trifasciata Stor., 1837, J. B. N. H. S., I, 417.

Hydrargyra vernalis Val., 1846, C. V. Poiss., XVIII, 206, pl. 531, fig. 2; Blkr., 1860, Cypr., 486.

Hydrargyra majalis Val., 1846, C. V. Poiss., XVIII, 207; Blkr., 1860, Cypr., 486; Gill, 1861, N. A. Fish, 52, — 1865, Can. Nat., ext. p. 16, — 1873, N. A. Fish, 31; Put., 1863, B. M. C. Z., p. 13; Bd., 1873, R. U. S. F. C., I, 826; Yarr., 1877, P. Phil. Ac., 214; Jor. & C., 1877, B. Buf. Soc., III, 141; Jor., 1878,

B. U. S. G. Surv., IV, 433, — Man. Vert., 262; G. & B., 1879, B. Ess. Inst., XI, 21; Goode, 1880, P. U. S. Mus., II, 118; Jor. & G., 1879, P. U. S. Mus., I, 384; Bean, 1881, P. U. S. Mus., III, 105.

Fundulus majalis Gthr., 1866, Cat., VI, 322; Jor. & G., 1883, P. U. S. Mus., V, 585; Ryder, 1886, P. U. S. Mus., VIII, 155, pl. XI, fig. 29–30; Jor., 1887, P. U. S. Mus., IX, 26; Bean, 1889, B. U. S. F. Com., VII, 132, 147, —1892, P. U. S. Mus., XIV, 92; Smith, 1892, B. U. S. F. Com., X, 65, pl. 19, fig. 1.

Fundulus (*Hydrargyra*) *majalis* Jor. & G., 1882, B. 16 U. S. Mus., 331, 332; Jor., 1887, R. U. S. F. Com., 836.

Fundulus similis Jor. & G., 1883, P. U. S. Mus., V, 585, 619.

B. 6; D. 14–13; A. 11–10; V. 6; P. 18; Ll. 36–33; Ltr. 13–12; Vert. 14 + 20.

Form somewhat elongate, compressed, not very wide at the shoulders, subquadrate in transverse section through the head, arch of back rather low, caudal pedicel moderately deep. Head long, pointed, as broad as deep, three tenths, or less, of the length to the base of the caudal; crown straight to slightly concave longitudinally, a trifle arched transversely. Snout elongate, one and one half times as long as the eye, blunt, not so steep or so much rounded as in *F. heteroclitus*. Mouth wide; lower jaw longer, upper protractile. Teeth conical, hooked, in bands, outer series larger; pharyngeal with a shoulder, hooked, a considerable number, and more with age, of the median resembling molars. Eye two thirds of snout, three sevenths of interorbital space, one fifth of head. Two to three rows of scales below the eye on the cheek. Origin of dorsal midway from nostril to tip of caudal, several rays forward of that of anal. Base of anal shorter than that of dorsal, but tip of fin reaching farther back. Anal of male becoming pointed, and concave on its hinder border. Pectorals reaching bases of ventrals. Caudal subtruncate, two thirds as broad as long, rays two thirds as long as head.

Olivaceous, centres of scales lighter, whitish to yellowish below, brownish, bronzed and puncticulate to silvery on the cheek, top of head dark. Males and young with ten to eighteen narrow bands of brown across the sides. Females when half grown or larger have a longitudinal band from the upper angle of the opercle to the middle of the caudal pedicel; commonly there is a shorter band below this more or less broken into spots; many have two bands below this long one and another above it. On the caudal pedicel the female usually has one or more vertical bands, the most distinct and longest being that nearest the rays. The upper end of the hindmost band on the pedicel is deepest in color and remains as a black spot in case the bands fade. The colors in young and old and male and female are well shown on Plate IX. A black spot is occasionally present on the posterior rays of the dorsal.

Attaining a length of six inches. Canada to Florida along the shores.

Fundulus similis.

Hydrargyra similis B. & G., 1853, P. Phil. Ac., VI, 389; Grd., 1859, Mex. Bd., Fish, 68, pl. 35, fig. 1–8; Blkr., 1860, Cypr., 486; Put., 1863, B. M. C. Z., p. 13; Jor. & C., 1877, B. Buf. Soc., III, 141; Jor., 1878, B. U. S. G. Sur., IV, 400, 433; G. & B., 1880, P. U. S. Mus., II, 151.

Fundulus similis Gthr., 1866, Cat., VI, 323; G. & B., 1883, P. U. S. Mus., V, 239; Jor. & G., 1883, P. U. S. Mus., V, 252, 619; Jor., 1885, P. U. S. Mus., VII, 109, 322; Jor. & S., 1885, P. U. S. Mus., VII, 230; Hensh., 1891, B. U. S. F. Com., IX, 374; Everm., 1893, B. U. S. F. Com., 1891, p. 84; Everm. & K., 1894, B. U. S. F. Com., 1892, pp. 66, 75, 77, 79, 83, 87, 89, 92, 106.

Fundulus (*Hydrargyra*) *similis* Jor. & G., 1882, B. 16 U. S. Mus., 331, 333, 891; Jor., 1887, R. U. S. F. Com., 836.

B. 6; D. 14–12; A. 11–10; V. 6; P. 18; Ll. 35–33; Ltr. 13–12; Vert. 15 + 19.

Similar to *F. majalis* in shape, but with longer snout and different coloration. Back considerably arched above the pectorals. Head elongate, one third of length to base of caudal, subquadrate in transsection, crown flat or slightly concave longitudinally. Snout long, twice the eye, as wide as deep, slightly turned upward in larger individuals, blunt; chin steep. Mouth wide, oblique, lower jaw longer, upper protractile. Teeth conical, in bands, outer series longer; pharyngeal with a shoulder, median resembling molars. Eye medium, twice in the snout, one and one half times in the interorbital space, four and one half times in the head. Three series of scales below the eye on the cheek. Dorsal origin about midway from opercle to base of caudal, little forward of that of anal. Base of anal opposed to that of dorsal, not reaching as far forward, and hardly as far backward. On males anal and dorsal are more or less pointed and the former has a slight indentation on the outer border, behind the point. Anal rays longer than those of dorsal. Caudal deep, two thirds as long as head, truncate.

Light olivaceous to yellowish, back darker, centres of scales lighter, silvery to brownish on the flanks, white to yellow beneath. With eight to twenty narrow bars of brown across the flank. The following are either present or absent according to the individual or sex: a blackish spot at the upper angle of the opercle, cloudings or spots in the fins, a black spot at the upper end of the hindmost bar on the base of the caudal, a dark band across the hind edge of the caudal, and an ocellate spot on the hinder rays of the dorsal. Cheeks commonly silvery. Largest specimen six and one half inches in length.

Texas; Louisiana; Alabama; Florida.

Fundulus Rathbuni.

Plate II. Fig. 9, teeth.

Fundulus (*Xenisma*) *rathbuni* Jor., 1889, P. U. S. Mus., XI, 351, 356, pl. 44, fig. 7.

B. 6 (rarely 5); D. 11–12; A. 12–13; V. 6; P. 16–17; Ll. 36; Ltr. 12–13; Vert. 16 + 19.

From intermediate between that of *F. catenatus* and that of *F. heteroclitus*, with nearer approach to the latter. Body stout, compressed, caudal region deep. Head broad, one fourth of the total length; crown flat. Snout medium, blunt; chin moderately steep. Mouth wide; lower jaws longer, upper protractile. Teeth conical, in bands, outer series longer; pharyngeal with a shoulder, a few stout and thick, groups small, as in heteroclitus. Eye large, as long as snout, three and one third times in the head, two thirds of the interorbital space. Pectorals and ventrals small. Dorsal and anal elongate, acuminate posteriorly. Dorsal origin close to the middle of the total length. Base of anal shorter than that of dorsal, opposed. Caudal deep, rounded on hind margin. Oviduct slightly extended on the anal.

Olivaceous, light to rusty, lighter below, silvery on cheeks, white on throat; with few to many small spots of brown on head and flanks. The spots sometimes form short bars, becoming more or less confluent. Edges of scales darker, forming reticulations. The specimens examined are without large spots on the fins. On the bases of the caudal rays there are some small ones, and on the dorsal there are a few faint indications of others. If it were not for the six branchiostegal rays, in most cases, it would be difficult to find reasons for separating this species from *F. heteroclitus;* to which it would bear much the same relationship as exists between the brown spotted and the silver flecked individuals of *F. grandis*. About three inches.

Fresh waters of North Carolina.

Fundulus catenatus.

Plate II. Fig. 11, teeth.

Pœcilia catenata Stor., 1846, Syn., 178, — Mem. Am. Ac., II, 430.

Hydrargyra catenata Ag., 1854, Am. Jour. Sci., XVII, 353, extr. p. 15; Blkr., 1860, Cypr., 486; Put., 1863, B. M. C. Z., 7.

Fundulus catenatus Gthr., 1866, Cat., VI, 322; Cope, 1869, J. Phil. Ac., 238, — 1877, P. Am. Phil. Soc., XI, 456; Jor., 1887, R. U. S. F. Com., 837; Jor. & G., 1887, P. U. S. Mus., IX, 5, 12; Gilb., 1891, B. U. S. F. C., IX, 149; Meek, 1891, B. U. S. F. Com., IX, 118, 122, 130, 134, 138, 146; Kir., 1892, B.

U. S. F. Com., X, 291; Woolm., 1892, B. U. S. F. Com., X, 258, 263, 266, 269; Garm., 1894, B. Ess. Inst., XXVI, ext. p. 47.

Zygonectes catenatus Jor., 1876, Man. Vert., 252.

Xenisma catenata Jor. & C., 1877, B. Buf. Soc., III, 142; Jor., 1878, Man. Vert., 263, — B. U. S. G. Surv., IV, 433; Jor. & B., 1878, B. 12 U. S. Mus., 62, 77.

Fundulus (*Xenisma*) *catenatus* Jor. & G., 1882, B. 16 U. S. Mus., 337.

Xenisma stellifera Jor., 1876, Ann. N. Y. Lyc., 322, — 1878, B. U. S. G. Surv., IV, 411, 433; Jor. & C., 1877, B. Buf. Soc., III, 142; Jor. & B., 1878, B. 12 U. S. Mus., 48.

Fundulus (*Xenisma*) *stellifer* Jor. & G., 1882, B. 16 U. S. Mus., 337.

Fundulus stellifer Jor., 1887, R. U. S. F. Com., 837; Gilb., 1891, B. U. S. F. Com., IX, 155, 158.

B. 6–5; D. 15–14; A. 16–15; V. 6; P. 16–15; Ll. 45–53; Ltr. 13–14; Vert. 17 + 20.

Body moderately elongate and compressed, depressed anteriorly and on the head. Head broad, three and a half times in the length to the caudal, or more than four times in the total; crown flat. Snout medium, broad, blunt; chin moderately steep. Teeth conical, in bands, outer series larger; median pharyngeal teeth enlarged, blunt, others hooked. Eye large, two thirds of either snout or interorbital space, two sevenths of head. Dorsal anal and ventrals somewhat larger, broader and deeper, and ending in a sharper angle on males than on females. Origin of dorsal about midway from base of pectoral to base of caudal. Base of anal opposed to that of dorsal and originating a little farther back. On females the anal appears to extend a little farther back than the dorsal. The oviduct is prolonged a short distance on the first anal ray. Intestine about equal to the total length, not much convolute. Caudal broad, subtruncate or rounded.

Light olivaceous to greenish olive, light to dark; with small spots of brown forming more or less irregular longitudinal streaks on the flanks. On males the brown becomes less distinct in cases giving rise to a more uniform coloration on the upper surfaces, which fades into silvery on the flanks and below. The male most often bears a blackish band near the hind border of the caudal fin, in front of a narrow edging of white or cream color. More rarely the dorsal is dark and has a white border. Scattered spots of orange, present in life, disappear in the alcohol. Reaches a length of six inches.

Fresh waters of Kentucky and Virginia and southward.

Fundulus seminolis.

Plate II. Fig. 12, teeth.

Fundulus seminolis Grd., 1859, P. Phil. Ac., 59; Blkr., 1860, Cypr., 487; Gthr., 1866, Cat., VI, 325; Jor. & C., 1877, B. Buf. Soc., III, 141; Jor., 1878, B. U. S. G. Surv., IV, 433, — 1885, P. U. S. Mus., VII, 322, — 1887, R. U. S. F. Com., 837; Goode, 1880, P. U. S. Mus., II, 117; Jor. & G., 1882, B. 16 U. S. Mus., 334; Woolm., 1892, B. U. S. F. Com., X, 297, pl. 52, fig. 3.

B. 6; D. 18; A. 13 (14); V. 6; P. 20; Ll. 56; Ltr. 20; Vert. 17+18.

Form bearing some resemblance to *F. catenatus*. Elongate, stout, compressed. Head about one fourth of the total length, crown flat. Snout broad, blunt, one and one half times the length of the orbit. Mouth of medium size; lower jaw longer, upper protractile. Teeth conical, in bands, outer series larger; pharyngeal with a shoulder, many of the median becoming molars, like those of *F. majalis*. Eye large, less than five times in the head, more than half of the width of the forehead. Dorsal originating little in advance of half way from snout to end of tail, about six rays forward of the origin of the anal; base extending several rays farther back than that of the latter; upper margin convex; hind angle acute. Anal elongate, lower angle acute, hind margin concave. Caudal broad, length slightly greater than that of the base of the dorsal, two thirds of the head, truncate. Ventrals small, not reaching the anal. Pectorals medium, reaching a vertical from base of ventrals. Intestine short, extended, reaching nearly to end of anal fin.

Olivaceous, lighter beneath, opercle silvery; a brownish spot on the base of each scale, forming longitudinal vittæ. Fins with irregular transverse series of small spots or dots.

Attaining a length of five inches or more.

Florida.

Fundulus Dugesii.

Fundulus Dugesii Bean, 1888, P. U. S. Mus., X, 373, pl. 20, fig. 5; Eig., 1893, P. U. S. Mus., XVI, 56.

D. 15; A. 11; Ll. 30; Ltr. 11.

Body comparatively short and deep, depth less than one third of the total length, back somewhat arched. Head moderately broad, about equal depth of body, or nearly one third of the length to the base of the caudal; crown flattened. Snout short, less than eye; lower jaw longer, upper protractile; chin steep. Teeth conical, in a double series, outer larger. Eye longer than snout, two thirds of interorbital space, one fourth of head. Fins short, rounded. Dorsal and anal opposed, behind the middle of the total length. Dorsal origin midway from the upper angle of the opercle to the end of the caudal. Base of anal half as long as that of dorsal, below the middle of the latter. Caudal slightly convex, least depth of the pedicel half the depth of the body.

Light brown, with five or six broad vertical dusky bars on the flank, be-

tween head and caudal. One of the bands below anterior half of dorsal, another on the caudal pedicel. On sides and head tinted with green mixed with silver; belly yellowish; upper cheek bronze, lower silvery; operculum silvery.

Length about three inches.

Guanajuato, Mex. (Bean.)

Fundulus Luciæ.

Hydrargyra luciæ Bd., 1855, Ninth R. S. Inst., 344, ext. p. 30; Blk., 1860, Cypr., 486; Gill, 1861, N. A. Fish, 52; Bean, 1889, B. U. S. F. Com., VII, 129.

Haplochilus luciæ Gthr., 1866, Cat., VI, 316.

Zygonectes luciæ Jor., 1887, R. U. S. F. Com., 837; Smith, 1892, B. U S. F. Com., X, 67, pl. 18, fig. 3.

Fundulus luciæ Bean, 1889, B. U. S. F. Com., VII, 130, 132, 140.

"General form elongated, though of rather short appearance. Head constituting less than one fourth of the total length. Insertion of anal slightly in advance of origin of dorsal, and rather more developed than the latter. Ventrals very small; their extremity reaching the anus. Tail large. D. 8; A. 9; V. 6; P. 15; C. 6, 1, 8, 7, 1, 5.

"Dark olive green above, lower part of sides and beneath rich ochre yellow. Sides with 10 or 12 broad, well defined, vertically disposed dark bars, nearly as large as their interspaces, which are of a faint tint of greenish white. All the fins but the dorsal are of a uniform yellowish, lighter than the abdomen. Dorsal, yellow on the terminal half, the basal portions olivaceous, with a large black spot posteriorly, and immediately anterior to it a white one. The dark spot is bordered above and behind by the yellow part mentioned. In one specimen the posterior half of the base of the dorsal fin is dull white, with a large subcircular spot of black in the centre. Length about one inch. P. similar, the dorsal unspotted, the yellow less intense. A few specimens only were taken, in a small ditch at Robinson's landing, Peck's beach, opposite Beesley's point." (Baird.)

We are indebted to Smith for additional particulars. D. 8; A. 10; Ll. 34–35; Ltr. 10–11. Head two sevenths of length to base of caudal; eye two thirds of snout and two thirds to three fourths of interorbital space.

It will readily be seen that this form might be derived from the ornate types of *Fundulus heteroclitus*. The only difference to be noted lies in the short dorsal. Examination of a large number of individuals of this species of Fundulus discovers none on which the dorsal has less than ten rays. The lack of a couple of the anterior in a young specimen is all that is needed to

provide a type that would agree perfectly with the descriptions of Luciæ, in respect to origin of dorsal and all other particulars. The proper standing of the species Luciæ is not yet satisfactorily determined.

Fundulus Goodei.

Plate III. Fig. 4, teeth.

Lucania Goodei Jor., 1879, P. U. S. Mus., 240, — 1887, R. U. S. F. Com., 837; Jor. & G., 1882, B. 16 U. S. Mus., 343; Woolm., 1892, B. U. S. F. Com., 294, 296, 300, pl. 53, fig. 2.

B. 5; D. 10–12; A. 10–11; V. 6; P. 12; Ll. 29–32; Ltr. 8; Vert. 14 + 16.

Body compressed, tail moderately deep. Head nearly one fourth of the total length; crown flattened. Snout short, nearly as long as the eye, blunt; chin steep. Mouth of moderate size, oblique; lower jaws longer, firmly united; upper short, protractile. Teeth conical; outer series strong, hooked; inner similar in shape to outer but very small; pharyngeal with a shoulder. Eye large, longer than the snout in small specimens, nearly as wide as the interorbital space. Dorsal rather large, originating about midway from snout to base of caudal. Anal little smaller than dorsal, tip and base extending a little farther backward than those of the latter. Pectorals small, hardly larger than the ventrals and reaching a trifle behind their bases. Caudal deep, convex. Scales large.

Olivaceous, silvery on lower half of head and on belly, edges of scales darker. A blackish band from the lower jaw along the flank to the middle of the base of the caudal. A dark band from the lower edge of the caudal passes forward below the pedicel to each side of the base of the anal. A transverse band of dark color on the basal half of dorsal and anal, varying in distinctness. Tips of fins darkened.

Florida.

The possession of inner series of teeth on the jaws places this species in Fundulus, rather than in Lucania, the essential characteristic of which is the single series of teeth on each jaw.

Fundulus hispanicus.

Plate III. Fig. 1, teeth.

Hydrargyra hispanica Val., 1846, C. V. Poiss., XVIII, 214, pl. 531, fig. 1; Steind., 1865, Sb. Ak. Wien, LII, pl. ? , fig. 4, 5.

Cyprinodon iberus Bellotti, 1858, Mem. Ac. Sc. Torin., XVII, p. clx.

Fundulus hispanicus Gth., 1866, Cat., VI, 326; Sauv., 1880, Nouv. Arch. Mus., III, (2) 27; Seel., 1886, Fish. Eur., 22, 371.

B. 6; D. 11–9; A. 11–14; V. 6; P. 14; Ll. 29–32; Ltr. 8–9; Vert. 14 + 15.

Body comparatively stout, short and thick, compressed behind the head, caudal pedicel deep and short, head and nape broad, depressed on the upper surface. Head longer than depth of body, nearly one third of the length to the base of the caudal, as broad as deep, crown flat. Snout short, not as long as the eye, blunt, rounded; chin steep. Mouth large, directed obliquely upward, lower jaws longer, firmly united; upper short, protractile. Teeth conical, hooked; outer series larger, in open order; inner small, in bands; pharyngeal with a shoulder. Eye large, little longer than the snout, nearly two fifths of the head, half of the forehead. Dorsal origin almost directly opposite that of anal, two thirds of the distance from the eye to the base of the caudal, or half of that from the occiput to the end of the caudal fin. Anal larger, deeper and reaching farther back than dorsal. Ventrals small, not reaching anal. Pectorals narrow, pointed, not reaching bases of ventrals. Caudal deep, short, little more than half as long as the head, convex on the hind margin. Scales large. Intestine short, hardly as long as head and body.

Olivaceous, light and yellowish to dark and brownish, whitish to silvery beneath and on the lower half of the head, edges of scales darker. A small spot of brown on the base of each scale, of the upper flank and back, gives the appearance of vittæ. Fins plain, or with transverse streaks, or clouded, or darker toward the tips. A darkish streak behind the eye. A faint darkish streak along the middle of the side. Top of head dark. Small to medium sized specimens have a blackish patch behind the upper angle of the operculum, half a dozen or more narrow, more or less distinct, vertical streaks of brown on the hinder portion of the body, and transverse series of dots on dorsal anal and caudal, more or less zigzag on the last. Small and light colored individuals have a narrow band of brownish from the eye around the lower lip. Largest specimen two and one half inches.

Fresh waters of Spain.

Fundulus nisorius.

Fundulus nisorius Cope, 1877, P. Am. Phil. Soc. (2d ed. of extra) 456.

"Stout; head four times in length to basis caudal; orbit four times in length of head, and twice in interorbital width. Depth 3.75 times in length.

Anal fin commencing about opposite the middle of the dorsal. Cheek scaly, operculum smooth. Scales of body in 36 transverse, and 12 longitudinal series. Radii D. 12, A. 10 or 11, extending more than half way from basis of first ray to basis caudal. Length of female four inches. Color uniform light brown, yellowish below. Most of the specimens of this species (seven) are females, and in them the oviducts are prolonged in a tube to near the extremity of the first ray of the anal fin. Several have many well developed eggs in the former. Small, faintly cross-banded specimens, perhaps males, do not present this character. There are no pseudo-branchiæ. From Gaboon, W. Africa." (Cope.)

Known only from the foregoing.

Fundulus capensis sp. n.

Plate III. Fig. 2, teeth.

B. 5; D. 13; A. 13; V. 6; Ll. 36; Ltr. 11.

Form resembling that of *F. heteroclitus*. Body compressed; head broad, depressed, crown flat. Snout short, rounded from the eye forward, blunt; chin steep. Mouth of medium size, directed obliquely upward; lower jaws longer, firmly joined; upper short, protractile. Teeth slender, pointed; outer series larger, hooked, appearing slightly expanded near the apex; inner similar to outer, very small, in bands; pharyngeal with a shoulder. Eye large, nearly twice the snout, two fifths of the head, little less than the interorbital space. Dorsal origin midway from middle of eye to base of caudal, slightly forward of vent. Anal origin nearly under middle of base of dorsal. Scales small. Caudal convex.

Olivaceous, edges of scales darker. Top of head darker, crossed by a lighter band in front of the eyes. Opercle silvery, crossed by a darkish streak behind the eye. Belly whitish or silvery. A faint band of silvery from the operculum to the caudal along the middle of the side. Five or six broad blotches of brownish across the flanks, separated by rather wider spaces of the lighter color. A vertebral darkish streak, more distinct behind the dorsal; a similar line between anal and lower edge of caudal. A band crosses the caudal near its base. Darker color shows faintly through the silvery band on the flanks.

Specimen described one inch in length. It may be that with material in better condition, and a knowledge of the sexual peculiarities, a different dis-

position of this form will have to be made. This possibility is suggested by the shape of the teeth, which is not that of other Funduli, but rather an approach to that of *Heterandria formosa*.

False Bay, Cape of Good Hope.

Fundulus tæniopygus.

Fundulus orthonotus Gth., 1866, Cat., VI, 326; Playf. & Gth., 1866, Fish. Zanzib., 118, pl. 17, fig. 2, 3; Sauv., 1880, Nouv. Arch., III (2), 7, 15, 27.
Fundulus (*Nothobranchius*) *orthonotus* Hilg., 1888, Ges. Nat. Fr., 78.
Nothobranchius orthonotus Hilg., 1891, Ges. Nat. Fr., 19.
Nothobranchius tæniopygus Hilg., 1891, l. c., 20.
Fundulus Güntheri Pfeff., 1893, Jahrb. Hamb. Anst., X, ext. p. 39.

D. 15; A. 15–16; V. 5; Ll. 30–32; Ltr. 10.

Depth of body or length of head three tenths of the length to the base of the caudal. Head thick, short; snout blunt. Lower jaw projecting beyond the upper. Eye as long as snout, half of interorbital space, two ninths of head. Dorsal origin half way from eye to root of caudal in males, or half way from preoperculum to base of caudal in females. Anal origin opposite that of dorsal in males, more backward on females, which, besides, have the anterior rays of the anal stiff and inflexible. Fins more elongate on the male, which sex has all the scales provided with a carmine-red margin. Sides of head and dorsal and anal with carmine-red spots. Caudal red. Tail, base of anal and caudal dotted with black on the female.

East Coast of Africa; Seychelles. (Günther.)

Fundulus Antinorii.

Haplochilus Antinorii Vinciq., 1883, Ann. Mus. Civ. Gen., XVIII, 693, fig.

D. 11; A. 14; V. 6; Ll. 30.

Length of head one fourth or more of the length from snout to base of caudal, depth of body little less. Crown flattened. Snout short, blunt, chin steep. Mouth directed upward; lower jaws longer; upper short. Eye large, longer than snout, about one third of the length of the head, equal the interorbital space. Dorsal origin near the middle of the total length, opposite that of the anal in females, above the eighteenth scale of the lateral line. Anal of male slightly advanced. Base of anal longer than that of dorsal. Ventrals small, not reaching the anal. Pectorals rounded, reaching beyond a vertical from the bases of the ventrals.

Colore corporis in mare virescenti, in fœmina luteo, fusco arenato, pinnis griseis marginibus nigris."

"Lago Arsadé, nella regione degli Adda-Galla al sud della Scioa."

(Vinciguerra.)

It is evident that this species is out of place in Haplochilus. Without examining the teeth, the best we can do is to place it with the Funduli.

Fundulus virescens.

Fundulus virescens Schleg., 1850, Fauna Jap., IV, Pisc., 225, pl. 102, fig. 6; Blk., 1853, Verh. Bat. Gen., XXV, ext. p. 18, — 1854, XXVI, ext. p. 32.

Fundulichthys virescens Blk., 1860, Cypr., 485, — A. S. S. I. N., VIII, ext. p. 59, — 1879, Verh. K. A. W., XX, ext. p. 24.

"B. 4; D. 9; V. 7; P. 14; C. 18.

"L'individu dont nous publions la figure, était long d'un peu plus de deux pouces, taille qu'acquiert ordinairement l'espèce. La longueur de la tête de ce poisson égale la hauteur du tronc aux pectorales, et fait environ le cinquième de la longueur totale du poisson. Les mâchoires sont armées, suivant M. Bürger, de plusieurs rangées de dents, dont les mitoyennes sont plus grandes que les autres. Les yeux sont de grandeur moyenne. Les écailles sont passablement grandes, et la ligne latérale est plus rapprochée de celle du dos que de celle du ventre. L'anus est plus rapproché de l'extrémité de la caudale que de celle de la tête. La dorsale occupe précisément le milieu de la ligne supérieure du poisson; elle est petite ainsi que l'anale. La caudale est un peu échancrée à l'extrémité. Les pectorales naissent au-dessous de l'angle de l'opercule.

Ce poisson est, à l'état frais, d'un vert olivâtre foncé sur le dos, plus pâle sur les côtés de l'animal, et passant au blanchâtre sur les parties inférieures. La dorsale, l'anale et notamment la caudale, tirant au jaune orangé.

"Oomedaka est le nom sous lequel les Japonais désignent ce petit poisson, très commun dans les ruisseaux et petites rivières qui se jettent dans la baie de Nagasaki." (Schlegel).

The figure places the dorsal entirely forward of the anal, above the middle of the space between the latter and the ventrals; this and the forked tail make the outlines resemble those of some Cyprinoids rather than the Cyprinodonts in general. It is known only from the original description and figure, which are insufficient for determination of affinities or position.

A very doubtful addition to Fundulus.

EMPETRICHTHYS.

Empetrichthys Gilb., 1893, N. A. Fauna, No. 7, pt. 2, p. 233.

Head and body compressed, mouth oblique, chin steep. Teeth conical, in bands. Pharyngeal bones massive; teeth resembling molars, much as in *Fundulus majalis*. Branchiostegal rays five. Dorsal and anal opposed, behind the middle of the body. Intestine of moderate length.

Allied to Fundulus through the more compressed species.

Empetrichthys Merriami.

Empetrichthys merriami Gilb., 1893, l. c., p. 234, pl. 5.

B. 5; D. 11-13; A. 13–15; Ll. 33–34; Ltr. ca. 16.

Deeper and more compressed than *Umbra limi*, to which there is some resemblance. Head compressed, crown slightly convex. Mouth very oblique; maxillary reaching little behind front edge of the eye. Eye small, once the snout, half the interorbital space, one fifth of the head. Fins medium, angles blunt or rounded. Dorsal near midway from head to end of caudal, opposite the anal. Caudal broad, subtruncate. Pectorals rounded, extending half way to vent. Intestine one and one half times as long as the body.

Back brownish; lighter on flanks and below; irregularly blotched or clouded on the flanks with brown and white; fins brownish, more or less clouded with brown. Scales on the ventral surfaces in cases with lighter borders.

Ash meadows and the Pahrump Valley, Nevada, near the California line. (Gilbert.)

ZYGONECTES.

Zygonectes Agassiz, 1853, Am. Jour. Sci., XVI, 135, — 1854, Am. Jour., XVII, 353, — Fish. Tenn., 15; Grd., 1859, P. Phil. Ac., 113; Jor. & G., 1882, B. 16 U. S. Mus., 338.
Micristius Gill, 1865, Can. Nat., ext. p. 24; Jor. & C., 1877, B. Buf. Soc., III, 142.
Haplochilus (part) Gthr., 1866, Cat., VI, 310.

Intermediate in general features between Fundulus and Haplochilus. Body compressed posteriorly, depressed forward. Crown flat. Snout short, broad. Mouth slightly oblique; upper jaws shorter, protractile, not expanded and produced as in Haplochilus; lower longer, firmly joined. Teeth conical, in bands. No vomerine teeth. Dorsal and anal behind the middle of the body, opposed, the former smaller and originating above or a little

behind the origin of the latter; fins similar in the sexes. Caudal very convex or pointed. Intestine short.

This genus is so closely allied to Fundulus that separation is difficult. The most noticeable distinctive feature obtains in the backward position and the smaller size of the dorsal fin, smaller than the anal. From Haplochilus the genus is distinguished by lack of the expansion and production of the intermaxillaries and by the opposition of dorsal and anal. Zygonectes and Haplochilus have been thrown together by some authorities; but a consistent adherence to such an estimate of the actual affinities would necessitate uniting both with Fundulus.

North American.

Zygonectes olivaceus.

Plate I. Fig. 14, teeth; Plate X. Fig. 10–13.

Pœcilia olivacea Stor., 1845, P. B. N. H. Soc., II, 51, — 1846, Syn., 178, — Mem. Am. Ac., II, 430.
Fundulus tenellus B. & G., 1853, P. Phil. Ac., 389.
Zygonectes tenellus Grd., 1859, P. Phil. Ac., 60; Blk., 1860, Cypr., 485.
Zygonectes olivaceus Ag., 1854, Am. Jour., XVII, 353, — Fish Tenn. Riv., 15; Blk., 1860, Cypr., 485.
Zygonectes zonatus Ag., 1854, Am. Jour., XVII, 353, — Fish. Tenn. Riv., 15.
Zygonectes lateralis Ag., 1854, Am. Jour., XVII, 353, — Fish. Tenn. Riv., 15; Blk., 1860, Cypr., 485.
Zygonectes pulchellus Grd., 1859, P. Phil. Ac., 113; Blk., 1860, Cypr., 485; Jor., 1874, Fish. Indiana, 32.
Haplochilus pulchellus Gth., 1866, Cat., VI, 314.
Zygonectes notatus Nels., 1876, B. Ill. Lab., I, 42; Jor. & C., 1877, B. Buf. Soc., III, 142; Jor., 1877, B. 9 U. S. Mus., 47, — 1878, B. Ill. Lab., I, No. 2, p. 52, — 1878, Man. Vert., 264, — 1878, B. U. S. G. Surv., IV, 411, 433, — 1887, R. U. S. F. Com., 837; Jor. & B., 1878, B. 12 U. S. Mus., 62, 77; Forb., 1878, B. 2 Ill. Lab., 78, 85, — 1883, B. 6 Ill. Lab., 71, 93, — 1890, B. Ill. Lab., II, 499; Cope, 1880, B. 20 U. S. Mus., 34; Hay, 1881, P. U. S. Mus., III, 501, — 1883, B. U. S. F. Com., 66, 74; Bean, 1882, B. U. S. F. Com., I, 206; Jor. & G., 1882, B. 16 U. S. Mus., 339, — 1887, P. U. S. Mus., IX, 5, 8, 12, 14, 16, 17, 19, 21; Everm. & F., 1885, P. Phil. Ac., 412; Hensh., 1888, Cin. Soc. N. H., 79; Everm. & J., 1889, P. U. S. Mus., XI, 43, 53, 56; Gilb., 1889, P. U. S., Mus., XI, 609, — 1891, B. U. S. F. Com., IX, 150, 155; Garm., 1890, B. Ill. Lab., III, 141, — 1894, B. Ess. Inst., XXVI, ext. p. 47; Bollm., 1890, B. U. S. F. Com., VIII, 223; Meek, 1891, B. U. S. F. Com., IX, 119, 128, 130, 134, 139, 140; Woolm., 1892, B. U. S. F. Com., 251, 258, 261, 263, 271, 273, 274; Everm. & K., 1894, B. U. S. F. Com., 1892, pp. 78, 81, 83, 92, 107, pl. 24, fig. 4; Eig., 1894, R. Ind. Biol. Surv., 94.
Fundulus aureus Cope, 1865, P. Phil. Ac., 78.
Haplochilus aureus Gth., 1866, Cat., VI, 315.

B. 5; D. 10–8; A. 12–10; V. 6; P. 14–15; Ll. 33–37; Ltr. 11–10; Vert. 17 + 18.

Body subfusiform in horizontal outline, depressed and flattened on head and nape, compressed from the head backward, deepest above the ventrals, moderately deep in the caudal pedicel. Head equal depth, one fourth of the length to the base of the caudal, depressed, as wide as deep. Snout wide, not deep, broadly rounded, little longer than the eye. Mouth wide; man-

dibles longer, firmly joined; intermaxillaries shorter, protractile. Teeth small, in bands, subconical, hooked, outer series larger. Eye large, shorter than snout, two sevenths of head, three fifths of interorbital space. Dorsal origin about midway from eye to tip of caudal, a trifle backward from the first ray of the anal. Anal larger than dorsal, base extending farther forward and not quite so far back, fin length varying with age and sex. Ventrals small, not reaching the anal. Pectorals small, reaching the bases of the ventrals. Median rays of caudal longer; fin rounded to bluntly pointed.

Light olivaceous to greenish or yellowish olive, with a band of brown or black passing from the snout, through the eye, above the pectoral, to the middle of the tail, about one scale and two half-scales in width. Back and flanks, to the lower edge of the band, commonly sprinkled with small spots of brown. Dorsal, anal, and caudal with smaller spots, to some extent forming transverse series. Top of head dark, frequently a light spot on the occiput. A light streak along the edge of the dark band on the flank is not rare. Below the band, lighter to white. Specimens marked with vertical bars of brown on the lower portion of the sides, as in Fig. 10, Plate X, are common. On many the spots are more numerous than on Fig. 12 of the same plate.

The variety to which the name *zonatus* was given by Agassiz, from Michigan, Wisconsin, Iowa, and Illinois, appears to have more distinct and persistent vertical bars than the southern representatives. In cases the lateral bars are broken into spots, in many the longitudinal band extends out upon the caudal. A phase of coloration frequently met with shows the band with the bars forming mere serrations or projections on its edges.

Alabama to Wisconsin.

This species has been identified by different authors with Semotilus? notatus of Rafinesque. It is, however, impossible to determine from the description of that author what he had before him. The following is his account: —

"107th species. Silverspotted chubby. *Semotilus? notatus.* Semotile taché. Breadth one sixth of the length, brownish, pale beneath; head small, obtuse, with a large silver spot on the forehead between the eyes, jaws nearly equal; dorsal fin opposed to the anal, tail oboval entire. It is found in the Cumberland River, and the Little River, a branch of it. Communicated by Mr. Wilkins. It is rather doubtful whether it belongs to this genus, or *Minnilus, Rutilus*, etc. It might perhaps be found to constitute a peculiar one by the small mouth without lips, and the posterior dorsal

fin. Vent posterior. Pectoral and abdominal fins oboval. Eyes large. Length three inches; good bait for Perch, Bass, Red-eyes or Ring-eyes, etc." Raf., 1820, Ichth. Ohio, 86.

A small obtuse head with a silver spot on the top (but not always between the eyes), dorsal opposed to anal, oboval entire tail, jaws nearly equal, small mouth (but not without lips), posterior dorsal fin, pectoral and abdominal fins oboval, vent posterior, and eyes large (especially in young) may refer to either of several species in the Cumberland; while in that described here as olivaceous of Storer, the silver spot is usually on the occiput when present, the mouth is large and has lips, and broad lateral bands are so conspicuous that one can hardly believe Rafinesque would describe a fish possessing them as merely "brownish, pale beneath."

Zygonectes cingulatus.

Plate I. Fig. 13, teeth.

Fundulus cingulatus Val., 1846, C. V. Poiss., XVIII, 197; Blk., 1860, Cypr., 486; Gill, 1861, Cat. N. A. Fish., 52.

Micristius cingulatus Gill, 1873, N. A. Fish., 31; Jor. & C., 1877, B. Buf. Soc., III, 142.

Zygonectes (*Micristius*) *cingulatus* Jor., 1878, B. U. S. G. Sur., IV, 433; Jor. & G., 1882, B. 16 U. S. Mus., 342.

Zygonectes cingulatus Jor. & G., 1883, P. U. S. Mus., V, 586; Jor., 1887, P. U. S. Mus., IX, 527; Bollm., 1887, P. U. S. Mus., IX, 463; Gilb., 1891, B. U. S. F. Com., IX, 158.

Fundulus zonatus Val., 1846, C. V. Poiss., XVIII, 196; Blk., 1860, Cypr., 486; Gill, 1861, N. A. Fish., 52.

Haplochilus zonatus Gth., 1866, Cat., VI, 316.

Micristius zonatus Gill, 1873, N. A. Fish., 31; Jor. & C., 1877, B. Buf. Soc., III, 142.

Zygonectes (*Micristius*) *zonatus* Jor., 1878, B. U. S. G. Sur., IV, 411, 433; Jor. & G., 1882, B. 16 U. S. Mus., 342.

Zygonectes chrysotus Put., 1863, B. M. C. Z., p. 13; Goode, 1880, P. U. S. Mus., II, 117; Jor., 1885, P. U. S. Mus., VII, 319, 322, — 1887, R. U. S. F. Com., 837; Hensh., 1891, B. U. S. F. Com., IX, 374; Woolm., 1892, B. U. S. F. Com., X, 296, 300, 301, pl. 53, fig. 1.

Haplochilus chrysotus Gth., 1866, Cat., VI, 317.

Micristius chrysotus Gill, 1873, N. A. Fish., 31; Jor. & C., 1877, B. Buf. Soc., III, 142.

Zygonectes (*Micristius*) *chrysotus* Jor., 1878, B. U. S. G. Sur., IV, 433; Jor. & G., 1882, B. 16 U. S. Mus., 342.

Gambusia arlingtonia G. & B., 1880, P. U. S. Mus., II, 118; Jor. & G., 1882, B. 16 U. S. Mus., 345; Jor., 1887, R. U. S. F. Com., 838.

Zygonectes Henshalli Jor., 1880, P. U. S. Mus., II, 237, — 1881, III, 21, — 1885, VII, 322, — 1887, R. U. S. F. Com., 837; Jor. & G., 1882, B. 16 U. S. Mus., 338.

Zygónectes rubrifrons Jor., 1880, P. U. S. Mus., II, 237, — 1881, III, 20, — 1887, R. U. S. F. Com., 837; Jor. & G., 1882, B. 16 U. S. Mus., 338.

Zygonectes auroguttatus Hay, 1886, P. U. S. Mus., VIII, 556.

B. 5 (rarely 6); D. 9–8; A. 10–12; V. 6; P. 14–15; Ll. 29–32; Ltr. 11–12; Vert. 15 + 17.

Depressed and flattened on head and nape; compressed behind the head; caudal pedicel deep. Head broad, flat on the crown, subquadrate in trans-

section, two sevenths of the length to the base of the caudal, almost equal greatest depth of body. Snout short, hardly as long as the eye, broad, very blunt; chin steep. Mouth wide; lower jaws little longer, firmly joined; upper shorter, protractile. Teeth conical, sharp, hooked, outer series larger. Eye large, little if any longer than the snout, two thirds of the forehead, two sevenths of the head. Dorsal origin nearly midway from occiput to tip of caudal, hardly as far forward as first anal ray, hind end of base a trifle farther back than that of anal. Ventrals small, not reaching anal. Pectorals small, hardly reaching bases of ventrals. The length of the caudal pedicel from the origin of the dorsal to the bases of the median caudal rays is about the length of the head; the depth is two thirds as much. Caudal fin nearly as long as the head, rounded. Genital tube of female extended a little in front of the anal, the anterior rays of which have a fold at each side of their bases.

Olivaceous, yellowish, golden or reddish, to brownish or blackish; back and top of head darker; opercle silvery. With or without eight to sixteen vertical bars of brown on the flanks. Dorsal, anal, and caudal plain, or clouded, or having more or less regular transverse series of dots. Some specimens have a light streak on each scale, forming longitudinal streaks on the flank. Many are freckled with golden, silvery, or light colored scales, in cases forming lines. Others have freckles of brown, on single scales, scattered over the body. Rarely a silvery band passes back from the opercles Frequently a light spot is present on the crown. A few are profusely blotched with black or brown. Occasionally indications of darker longitudinal bands are present. Reaches three inches and a half, or more.

The Carolinas to Texas.

Zygonectes Nottii.

Plate I. Fig. 10, 12, teeth; Plate X. Fig. 1–9.

Zygonectes Nottii Ag., 1854, Am. Jour. Sci., XVII, 353, — Fish. Tenn. Riv., 15; Blk., 1860, Cypr., 485; Jor., 1876, Man. Vert., 252; Jor. & C., 1877, B. Buf. Soc., III, 142; Jor. & B., 1878, B. 12 U. S. Mus., 31, 48; Jor. & G., 1882, B. 16 U. S. Mus., 341; Hay, 1886, P. U. S. Mus., VIII, 557; Gilb., 1890, B. U. S. F. Com., VIII, 227; Woolm., 1892, B. U. S. F. Com., X, 301.

Zygonectes (*Micristius*) *Nottii* Jor., 1878, Man. Vert., 264, — B. U. S. G., Sur., IV, 433.

Zygonectes lineolatus Ag., 1854, Am. Jour., 353, — Fish. Tenn. R., 15; Blk., 1860, Cypr., 485.

Zygonectes guttatus Ag., 1854, Am. Jour., 353, — Fish. Tenn. R., 15; Blk., 1860, Cypr., 485; Jor. & C., 1877, B. Buf. Soc., III, 142; Jor. & B., 1878, B. 12 U. S. Mus., 48; Jor. & G., 1882, B. 16 U. S. Mus., 341; Gilb., 1891, B. U. S. F. Com., IX, 158.

Zygonectes (*Micristius*) *guttatus* Jor., 1878, B. U. S. G. Sur., IV, 433.

Zygonectes dispar Ag., 1854, Am. Jour., 353, — Fish. Tenn. R., 15; Blk., 1860, Cypr., 485; Nels.,

1876, B. 1 Ill. Lab., 42; Jor., 1877, P. Phil. Ac., 67, — 1878, B. 2 Ill. Lab., 52, — 1887, R. U. S. F. Com., 837; Jor. & C., 1877, B. Buf. Soc., III, 142; Forb., 1878, B. 2 Ill. Lab., 78, 85, — 1883, B. 6, 72, 93; Hay, 1883, B. U. S. F. Com., II, 66; Gilb., 1885, P. U. S. Mus., VII, 208; Everm. & J., 1889, P. U. S. Mus., XI, 55; Eig., 1894, R. Ind. Biol. Surv., 94.

Zygonectes (*Micristius*) *dispar* Jor., 1878, B. U. S. G. Sur., IV, 433, — 1878, Man. Vert., 264; Jor. & G., 1882, B. 16 U. S. Mus., 341.

Zygonectes hieroglyphicus Ag., 1854, Am. Jour., 353, — Fish. Tenn. R., 15; Blk., 1860, Cypr., 485; Jor. & C., 1877, B. Buf. Soc., III, 142; Jor. & B., 1878, B. 12 U. S. Mus., 48; Jor. & G., 1882, B. 16 U. S. Mus., 341.

Zygonectes (*Micristius*) *hieroglyphicus* Jor., 1878, B. U. S. G. Sur., IV, 433.

Zygonectes melanops Jor., 1878, B. 2 Ill. Lab., 52; Hay, 1881, P. U. S. Mus., III, 501; Bean, 1882, B. U. S. F. Com., I, 206.

Zygonectes inurus Jor. & G., 1882, B. 16, U. S. Mus., 892, — 1883, P. U. S. Mus., V, 143; Forb., 1883, B. 6 Ill. Lab., 71, 93.

Zygonectes craticula G. & B., 1883, P. U. S. Mus., V, 433; Jor., 1887, R. U. S. F. Com., 837.

Zygonectes zonifer Jor. & M., 1885, P. U. S. Mus., V, 482; Jor., 1887, R. U. S. F. Com., 837.

Zygonectes Escambiæ Bollm., 1887, P. U. S. Mus., IX, 463; Everm., 1893, B. U. S. F. Com., 1891, p. 87; Everm. & K., 1894, B. U. S. F. Com., 1892, 78, 83, 90, 92, 107.

B. 5; D. 8–9; A. 10–11; V. 6; P. 14–12; Ll. 34–36; Ltr. 11–12; Vert. 15 + 18.

Form a little shorter than that of *Z. olivaceus*. Compressed from the head backward; depressed on the head, crown and nape flattened. Outline less arched from snout to dorsal than from snout to anal. Head broad, about two sevenths of the length to the base of the caudal or two ninths of the total. Snout nearly or quite as long as eye, varying with age, slightly narrowed at the mouth, blunt. Mouth of moderate size, a trifle oblique; lower jaws longer, firmly united; upper shorter, protractile. Teeth in bands, conical, hooked, outer series larger; pharyngeal with a shoulder. Eye large, about as long as the snout, one third or less of the head, two thirds of the forehead. Scales large, extending upon the base of the caudal. Intestine as long as the body excluding head and caudal. Dorsal and anal of medium size and rounded margins, opposed, behind the middle of total length; dorsal smaller and originating a little farther back than the anal, the comparative position of the origin varying slightly with age and sex. The base of the dorsal extends little if any nearer the caudal than that of the anal. Caudal large, median rays longer, posterior border convex, almost pointed. Ventrals small, not reaching the anal. Pectorals small, reaching to, or a little beyond, a vertical from the bases of the ventrals.

The northern variety, *Z. lineolatus* Ag., shows a tendency to more scales and fin rays than the southern or typical forms.

Olivaceous, greenish, yellowish, reddish or brownish, lighter to silvery below, each scale with a brown more or less distinct spot, forming vittæ.

On some of the darker types, Plate X. Fig. 8, the spots form narrow longitudinal stripes. A black blotch extending from the eye down and backward is rarely absent. Narrow vertical bars of brown across the flanks are commonly present, sometimes as many as eighteen; on forms like those shown on Plate X. Fig. 6 and 9, the bars are obsolete. Fins marked with small dots, sometimes in two or more regular transverse series, frequently plain, clouded, or puncticulate. Top of head darker, in many cases with a silvery spot on the occiput; frequently light to whitish above the snout and between the eyes. Occasionally the spaces between the bars on the flanks are silvery. Cheeks silvery to bronzed.

Alabama to Iowa and Virginia.

Zygonectes sciadicus.

Plate II. Fig. 1, teeth.

Fundulus sciadicus Cope, 1865, P. Phil. Ac., 78, 316.

Haplochilus sciadicus Gth., Cat., VI, 316.

Zygonectes sciadicus Jor. & C., 1877, B. Buf. Soc., III, 142; Jor., 1887, R. U. S. F. Com., 837.

Zygonectes (*Micristius*) *sciadicus* Jor., 1878, B. U. S. G. Sur., IV, 433; Jor. & G. 1882, B. 16 U. S. Mus., 342.

Haplochilus floripinnis Cope, 1874, P. Am. Phil. Soc., 138, ext. p. 12; Cope & Y., 1875, Zool. Wheel. Exp., V, 695.

Zygonectes floripinnis Jor. & C., B. Buf. Soc., III, 142; Jor., 1878, B. U. S. G. Sur., IV, 433, — 1887. R. U. S. F. Com., 837, — 1891, B. U. S. F. Com., IX, 8; Jor. & G., B. 16 U. S. Mus., 339.

Var. **lineatus.**

Zygonectes lineatus Garm., 1881, B. M. C. Z., VIII, 88; Jor. & G., 1882, B. 16 U. S. Mus., 339; Jor., 1887, R. U. S. F. Com., 837.

Zygonectes Macdonaldi Meek, 1891, B. U. S. F. Com., IX, 122, 126, pl. 42, fig. 1.

Fundulus albolineatus Gilb., 1891, B. U. S. F. Com., IX, 141, pl. 43, fig. 1.

B. 5; D. 10–11; A. 12–14; V. 6; P. 14–16; Ll. 36–39; Ltr. 11–13; Vert. 15 + 18.

Compressed behind the head, depressed on head, flattened on crown; caudal pedicel moderately deep. Head as broad as deep, two sevenths of the length to the base of the caudal, more than depth of body. Snout rounded at the end, as long as the eye. Mouth wide, slightly oblique; lower jaws longer, firmly united; upper shorter, protractile. Teeth conical, hooked, in bands, outer series larger. Eye large, as long as the snout, or longer in young, three fifths of forehead, two sevenths of head. Origin of dorsal behind the middle of the total length, a very little backward of that of anal. Anal larger than dorsal and opposed, origin a trifle in advance; like the dorsal this fin is rather pointed. Caudal medium, varying from much to little convex on the hind border. Ventrals small, not reaching the anal, varying

in length in the sexes. Pectorals short, not reaching the bases of the ventrals. Scales medium, the smaller ones on the caudal rays were not included in the numbers given above.

Olivaceous, yellowish to dark brownish, light to dark; back darker, with or without a darker vertebral streak and darker centres to the scales; belly light to whitish; opercle silvery. In some localities the color is very light, more or less blotched or clouded with large areas of darker. In the breeding season the fins are rather highly colored.

The variety *lineatus* tends toward an increase in the number of fin rays and in the rows of scales; the color is darker on the centres of the scales, and the fins are darker toward their tips.

The top of the head is commonly marked with whitish in the midst of darker; in many the crown is dark, unmarked. Little darker along the lateral line.

Described from two-inch specimens.

Dakota southward in tributaries of the Mississippi.

Zygonectes Jenkinsii.

Zygonectes jenkinsii Everm., 1892, B. U. S. F. Com., for 1891, 86, pl. 36, fig. 2,—1894, B. U. S. F. Com. for 1892, pp. 83, 87, 89, 92, 107, pl. 24, fig. 3.

B. 5; D. 8–9; A. 11–12; V. 6; P. 14–15; Ll. 30–32; Ltr. 9–8; Vert. 15+18.

Moderately elongate and slender, compressed posteriorly, depressed on the head, depth of a specimen of one and five eighths inches two ninths of the length to the base of the caudal. Head two sevenths of the length, excluding the caudal, narrowed forward, crown flat. Snout nearly as long as the eye, pointed, chin not very steep. Mouth wide, not much directed upward; lower jaws longer, firmly joined; upper short, protractile. Outer series of teeth conical, hooked, stronger near the symphyses; inner small, similar in shape to the outer. Eye large, little longer than snout, nearly one third of head, three fourths of forehead. All fins with rounded margins. Dorsal smaller than anal, originating above its fourth or fifth ray, or about midway from the base of the pectoral to that of the caudal. Pectorals reaching a vertical from the bases of the ventrals. Ventrals small. Caudal not as long as the head, median rays a trifle the longer.

Light rusty olivaceous, edges of scales darker, belly golden to silvery,

lower surface of head silvery, top of head darker, with or without a blackish line along the middle of the flank and transverse cloudings on the fins. Small scattered spots of brownish are usually present along the middle of the flank, in cases arranged in a longitudinal series in a darkish band from the opercle to the base of the caudal. Under a powerful lens, body, head, and to some extent the fins are seen to be puncticulated with darker.

Alabama to Texas.

HAPLOCHILUS.

Aplochilus McClell., 1839, As. Res., XIX, 301, 426; Blkr., 1863, Cypr., 483, 490, — 1863, Atl., III, 141. *Apocheilini* Blkr., 1860, Cypr., 483. *Aplocheiliformes* Blkr., 1863, Atl., III, 140.

Panchax Val., 1846, C. V. Poiss., XVIII, 580; Cant., 1849, J. As. Soc., 1234; Blkr., 1852, Verh. Bat. Gen., XXIV, extr. p. 22, — 1860, Cypr., 483, 488, — 1863, Atl., III, 141.

Haplochilus Gthr., 1866, Cat., VI, 310; Day, 1873, Fish. Ind. & Burm., 276, — 1878, Fish. Ind., I, 521.

Body depressed forward, compressed behind the middle; caudal pedicel deep. Head elongate, shovel-shaped in front, flattened on the crown. Snout broad, produced. Both jaws much depressed, with firm symphyses, upper jaws protractile. Teeth subconical, hooked, in bands. Body cavity less than half the total length; intestine short. Dorsal fin short, base extending farther back than that of anal. Anal longer than dorsal, farther forward. Japan, Asia, Africa, and Central America.

One American species has been described, from Costa Rica.

By snout, mouth, fins, and general features the species placed in this genus appear to be sufficiently distinguished from those of Zygonectes. To unite these genera, with the characters possessed, would necessitate placing both in Fundulus.

Haplochilus panchax.

Plate III. Fig. 7, teeth.

Esox panchax Ham. Buch., 1822, Gang. Fish, 211, 380, pl. 3, fig. 69.

Aplocheilus panchax McCl., 1839, As. Res., XIX, 302.

Aplocheilus chrysostigmus McCl., 1839, As. Res., XIX, 301, 426, pl. 42, fig. 2; Blk., 1860, Cypr., 487.

Panchax Buchanani Val., 1846, C. V. Poiss., XVIII, 383; Blk., 1853, Ichth. Beng., 72, 144, — 1855, Nat. Tyd. Ned. Ind., IX, 392, 393, — 1857, A. S. S. I. N., III, 27, — 1859, En. Sp. Pisc. Ind., 155, — 1860, A. S. S. I. N., VIII, 25, 54, — Cypr., 487, 488, — 1863, Atl., III, 141, pl. 144 (Cypr. 43), fig. 3; Blyth, 1858, J. As. Soc. Beng., 288; Mart., 1876, Preuss. Exp. Zool., I, 209.

Panchax Kuhlii Val., 1846, C. V. Poiss., XVIII, 384.

Panchax Panchax Cant., 1849, J. As. Soc., 1234, Cat., 252.

Panchax melanotopterus Blk., 1850, Verh. Bat. Gen., XXII, ext. p. 22, — 1852, XXIV, ext. p. 22, — 1853, Ichth. Beng., 145, — 1860, Cypr., 487.

Haplochilus panchax Gth., 1866, Cat., VI, 311; Day, 1872, J. As. Soc., 259,—1873, Fish. Ind. & Burma, 276,—1878, Ind. Fishes, 523, pl. 121, fig. 3; Mart., 1876, Preuss. Exp. Zool., I, 232, 401; Beav., 1877, Fish. Ind., 155; Jan., 1882, Term. Füz., V, Hung. Nat. Mus., ext. p. 35.

B. 6; D. 8; A. 16; V. 6; P. 14; Ll. 30; Ltr. 8; Vert. 15+17.

B. 5–6; D. 7–11; A. 15–17; V. 6; P. 15; Ll. 31–34; Ltr. 9–10 (Day).

Body compressed, caudal pedicel moderately deep, head depressed. Head two sevenths of the length to the base of the caudal, crown flat. Snout longer than the eye, broad, blunt. Mouth wide, horizontal, jaws nearly equal. Outer series of teeth larger. Vomerine teeth present. Eye less than snout, three fifths of forehead, two sevenths of head. Origin of dorsal nearly above the end of the base of the anal. Ventrals small.

Greenish to olive, light below. A silvery spot on the occiput. Basal half of dorsal with a large spot of dark. Margins of fins lighter. Reaches a length of more than three inches.

Singapore; East Indies; Calcutta.

Haplochilus lineatus.

Plate III. Fig. 8, teeth.

Panchax lineatum Val., 1846, C. V. Poiss., XVIII, 381, pl. 546; Blkr., 1853, Ichth. Beng., 72,—1860, Cypr., 487; Day, 1865, Fish. Malabar, 221.

Aplocheilus vittatus Jerd., 1849, Madras Jour. L. & Sc., XV, 330.

Haplochilus lineatus Day, 1873, Fish. Ind. & Burm., 276,—1878, Fish. Ind., I, 522; Beav., 1877, Fish. Ind., 156.

B. 6; D. 7; A. 17; V. 6; P. 14; Ll. 32; Ltr. 8; Vert. 14+17.

B. 5–6; D. 8–9; A. 15–17; V. 6; P. 15; Ll. 32–34; Ltr. 9. (Day.)

Shape of body similar to that of the preceding. Head four and one fourth, depth five to five and one fourth, and caudal four and one third times in the total length. Eye three and one half times in the head, one and one third times in the snout, and one and one half times in the forehead. Snout broad, depressed, rounded; jaws of equal length. Vomerine teeth present. Third ray of ventral prolonged in a filament. Median rays of caudal longer, fin rather pointed.

Greenish to olive, with six to ten narrow transverse bands of darker on the flank. On some the lighter centres of the scales form vittæ. A black spot at the base of the dorsal. Fins more or less marked with small spots. A silver spot on the occiput.

This species is said to attain the length of four inches. The specimens examined were secured at Canara.

Haplochilus Dayi.

Haplochilus (*Panchax*) *Dayi* Steind., 1892, Denk. Ak. Wien, LIX, 376, pl. 1, fig. 2-2ª.

D. 6–7; A. 15; Ll. 29–30.

Allied to *H. lineatus* but differing in coloration and in the fins. Head about half as wide as long. Snout three, and eye three and one half times in the length of the head. Vomerine teeth present. Dorsal origin above the base of the hindmost anal ray, 24–25 scales from the snout. Medium caudal rays longest. Second ray of ventrals prolonged; longer on males. Posterior rays and angle of anal produced on the male.

Fins more or less freckled or spotted with brown. Females commonly with six to eight vertical bars of brown on the lower portions of the flanks. Males with some or without any of the blotches on the sides. A silvery spot on the top of the head. (Steindachner.)

Ceylon.

Haplochilus rubrostigma.

Aplocheilus rubrostigma Jerd, 1849, M. J. L. & Sc., 331.
Panchax rubrostigma Day, 1867, P. Z. S. Lond., 706.
Haplochilus rubrostigma Day, 1872, J. As. Soc., 259,—1873, Fish. Ind. & Burma, 276,—1878, Ind. Fishes, 522, pl. 121, fig. 5; Beav., 1877, Fish. Ind., 156.
Aplocheilus affinis Jerd., 1849, M. J. L. & Sc., 331.

D. 8; A. 17–18; V. 6; P. 15; Ll. 33; Ltr. 9.

Body compressed, depth less than length of head; caudal pedicel more slender. Length of head near two sevenths of the distance from snout to base of caudal. Eye four fifths of snout, two thirds of forehead, four thirteenths of head. Jaws about equal in length, maxilla reaching to below first third of eye. Teeth in the outer row of each jaw much enlarged, hooked. Base of dorsal above the hindmost rays of anal. Anal rays much shorter anteriorly, increasing in length to the last. Second ray of ventral elongate, reaching the middle of the anal. Pectoral not quite as long as the head. Median caudal rays rather prolonged.

Reddish brown above, shading to yellowish on the sides and below. Each scale along the sides with a central red spot. A silvery spot on the occiput. A row, or two, of red spots along the base of the anal, and some on the dorsal. A few dark spots on the caudal. Reaches three inches.

Malabar coast of India; lower portion of the Coromandel coast. (Day.)

Haplochilus melastigma.

Aplocheilus melastigma McClell., 1839, As. Res., XIX, 301, 427, pl. 42, fig. 3; Blk., 1860, Cypr., 487.
Haplochilus melastigma Day, 1873, Fish. Ind. & Burm., 276, — 1878, Ind. Fishes, 522, pl. 121, fig. 4; Beav., 1877, Fish. Ind., 156.
Aplocheilus sp. McClell., 1839, As. Res., XIX, 302, pl. 55, fig. 4.
Aplocheilus McClellandi Blk., 1854, Nat. Tyd. Ned. Ind., VII, 323, — 1860, Cypr., 487.
Aplocheilus carnaticus Jerd., 1849, M. J. L. & Sc., 331.
Haplochilus argenteus Day, 1867, P. Z. S. Lond., 706, — 1873, Fish. Ind. & Burm., 276; Beav., 1877, Fish. Ind., 156.
Panchax cyanophthalmus Blyth, 1858, J. As. Soc. Beng., XXVII, 288, — 1860, p. 111; Blk., 1860, Cypr., 487.
Haplochilus cyanophthalmus Gth., 1866, Cat., VI, 312; Beav., 1877, Fish. Ind., 191.

D. 6–7; A. 20–24; V. 6; P. 15; Ll. 27; Ltr. 9–11.

Body compressed, deep in the middle, caudal pedicel much less. Depth three and three fourths to four, length of head four and one fourth, and length of caudal four and a half times in the total length. Eye equal snout or forehead, one third of head. Lower jaw longer. Teeth small, none on the palate. Dorsal base above last fourth of anal. Anal of some with rays extended beyond the membrane. Ventrals small, rays not prolonged. Pectorals as long as the head. Caudal rounded.

Dull green on the back, shading to dull white on the belly. Outer portion of anal white edged. A narrow dark line along the middle of the side terminates in a dull spot on the centre of the base of the caudal. Attains about one and one half inches.

Wynaad, and Madras Presidency, Orissa, Lower Bengal and Burma. (Day.)

Haplochilus javanicus.

Aplocheilus javanicus Blk., 1854, Nat. Tyd., Ned. Ind., VII, 323, — 1859, En. Pisc. Ind., 155, — 1860, Cypr., 487, 490, — 1863, Atl., III, Cypr., 142, pl. 144, fig. 2.
Haplochilus javanicus Gth., 1866, Cat., VI, 311; Jan., 1882, Term. Füz., V, ext. p. 35.

B. 5; D. 6; A. 25; V. 6; Ll. 30.

Body compressed, one fourth to two ninths as deep as long. Head pointed, flat on the crown, two ninths to one fifth of the length of the body. Eye four ninths to two fifths of the length of the head, in the middle third. Dorsal opposite the hinder portion of the anal. Caudal blunt, convex. Pectorals reaching behind the bases of the ventrals.

Body yellowish green, belly lighter. A narrow streak of violaceous from head to caudal. Fins plain, yellowish.

Java. (Bleeker.)

Haplochilus latipes.

Pœcilia latipes Schleg., 1850, Fauna Jap., Pisc., 224, pl. 102, fig. 5; Blk., 1853, Verh. Bat. Gen., XXV, ext. p. 18, —1854, Verh. B. G., XXVI, ext. p. 32; Mart., 1876, Preuss. Exp. Zool., I, 126.

Aplochilus latipes Blk., 1860, Act. Soc. Ind.-Ned., VII, Jap., VI, 99, —A. S. S. I. N., ext. p. 59, —Cypr., 487, —1879, Verh. K. A. W., XX, ext. p. 24.

Haplochilus latipes Gth., 1866, Cat., VI, 311; Mart., 1876, Preuss. Exp. Zool., I, 118, 401.

B. 5; D. 6; A. 19–20; Ll. 29.

Body compressed, depth about equal to length of head. Head depressed, one fourth of the length to the base of the caudal, or one fifth of the total. Snout shorter than the eye, blunt. Mouth directed upward; lower jaw longer; upper short, protractile. Eye large, longer than snout, one third of head. Dorsal small, origin about two thirds of the distance from eye to base of caudal, base above the posterior third of that of the anal. Anal large, origin a little in advance of the middle of the total length. Ventrals small, reaching the vent. Pectorals reaching behind a vertical from the bases of the ventrals. Caudal subtruncate.

Nearly uniform pale brownish, tinted with blue in life. Belly yellowish.

Fresh waters of Japan. (From lit.)

Haplochilus Playfairii.

Haplochilus Playfairii Gth., 1866, Cat., VI, 314; Playf. & Gth., 1866, Fish. Zanzib., 118, pl. XX, fig. 1; Playf., 1867, P. Z. S. Lond., 868; Blk., 1875, Poiss. Madagasc., 101; Pet., 1876, Mb. Brl. Ak., 445.

D. 12; A. 18; V. 6; Ll. 32; Ltr. 9.

Depth one fourth, and head four thirteenths of length from snout to base of caudal. Head rather elongate, much depressed anteriorly. Eye shorter than snout, one fourth of head, more than half of interorbital space. Jaws equal in length anteriorly. Dorsal origin midway from præoperculum to end of caudal, above eighteenth scale of lateral line or middle of anal fin. Pectoral hardly reaching beyond root of ventral; latter reaching anal. Conspicuous sexual differences in the fins not apparent.

Brownish, with three or four indistinct, serrated, dark, longitudinal bands. Sometimes a black line across the base of the middle dorsal rays. Attains a length of three and a half inches.

Seychelles. (Günther.)

Yellowish olive, in life, with about seven longitudinal rows of red spots (between the serrated bands) corresponding to the series of scales; opercles with four similarly colored lines; vertical fins spotted and reticulated with brown. (Playf. and Gth.)

Haplochilus fasciolatus

Haplochilus fasciolatus Gth., 1866, Cat., VI, 358; Sauv., 1880, Nouv. Arch. Mus., III (2), 23; Rocheb., 1883, Poiss. Seneg., 139.

D. 11; A. 18; V. 6–7; Ll. 28; Ltr. 9–10.

Depth one fourth of the length to the base of the caudal. Head rather elongate, little more than depth of body, depressed anteriorly. Snout longer than eye; lower jaw little longer than upper. Eye somewhat more than one fourth of the head, half of the interorbital width. Dorsal origin midway from eye to end of caudal, opposite the seventeenth scale of the lateral line, rather before the middle of the anal. Pectoral reaching beyond root of ventral; latter reaching vent.

Brownish, each scale with a red spot at the base. Lower parts of sides of the abdomen and tail with eight or nine oblique narrow brownish-black streaks, descending from the middle of the side forward. Vertical fins with purple spots, dorsal and anal with a light basal band. Reaching three inches in length.

Sierra Leone; Upper Nile. (Günther.)

Haplochilus senegalensis

Haplochilus senegalensis Steind., 1870, Sb. Ak. Wien, LXI, ext. p. 27, pl. 7, fig. 2.
Haplochilus Chaperi Sauv., 1882, B. Soc. Z. de F., 323, pl. 5, fig. 4–5.

D. 8; A. 15; Ll. 28 (+ 2 auf der Caudale). (Steind.)

D. 7; A. 15; Ll. 25. (Sauv.)

Depth five and two thirds to five and one fifth times, and head three and two fifths times in the length from snout to base of caudal. Head and forward portion of body depressed, elongate. Crown flat, lower jaw prominent. Eye little more than four times, and forehead twice in the length of the head. Dorsal origin near three fourths of the distance from snout to caudal base, or midway from the occiput to the same point, above or a little behind the middle of the anal. The original description and the figure do not agree as to position of fins. Pectoral reaching above base of ventral; latter above origin of anal. Caudal rounded, little longer than the head.

One of the types had twelve to thirteen narrow bands of brown descending obliquely forward across the flank, a longitudinal band a little above the middle of the flank from the eye to the caudal, and dorsal, anal, and caudal marked with brownish. Two others lacked the transverse bands, but had the

longitudinal band more distinct and possessed in addition a narrower band along the entire lower edge of the body to the caudal. Back violet brown; bands separated by yellowish. A brownish band around the lower jaw toward the eye. Dagana, Senegal. (Steindachner.)

Apart from the red markings of the scales, which belong to the sexually mature or the nuptial season, there seems to be little reason for the separation of *H. chaperi*, from freshwater in the lagoon "d'Assinie, à Couacrou," in the gold coast region.

Haplochilus Marnoi Steind., 1881, Sb. Ak. Wien, 198.

D. 8; A. 14–15; V. 6; Ll. c. 27; Ltr. $8\frac{1}{2}$.

This apparently is a variety of *H. senegalensis*. The locality given is Bahr el Seraf and Bahr el Gebel.

Haplochilus bifasciatus Steind., 1881, Sb. Ak. Wien, 199.

D. 6–7; A. 15; V. 6; Ll. 28; Ltr. $7\frac{1}{2}$.

The differences by which this form is distinguished from the preceding are mainly in the coloration: it has a couple of streaks of brown from the orbit to the base of the caudal and another from the lower edge of the base of the pectoral along the base of the anal and the lower edge of the caudal. I am inclined to place it as a variety of *H. senegalensis* with *H. Marnoi* from the same locality.

Haplochilus Petersii.

Haplochilus Petersii Sauv., 1882, Bull. Soc. Zool. de France, 324, pl. 5, fig. 6.

D. 7; A. 14; Ll. 32.

Depth six and two thirds, and head five times and a half in the total length. Head depressed; snout flat, as long as the eye. Lower jaw longer than upper. Eye little more than three times, and interorbital space little less than twice in the length of the head. Dorsal origin half way from eye to end of caudal, above the middle of the anal, or the twenty-first scale of the lateral line. Ventrals reaching the anal, not reached by the pectorals. Dorsal and anal not reaching the caudal. Caudal as long as the head, rounded.

Brownish yellow, edges of scales darker With eight vertical streaks of darker crossing the flanks. Caudal puncticulate; anal and dorsal greyish; ventrals whitish; pectorals slightly clouded.

"Lagune d'Assinie, à Couacrou," Western Africa. (Sauvage.)

A comparison of types of this form with specimens *H. spilargyreus*, *H. spilauchen*, and *H. senegalensis* will be necessary before deciding as to its relationship or position.

Haplochilus Johnstoni.

Haplochilus Johnstoni Gthr., 1893, P. Z. S. Lond., 627.

D. 7; A. 12–13; Ll. 29; Ltr. 7.

"The height of the body is one fourth or one fifth of the total length, without caudal; the length of the head a little less than one fourth. Head compressed; snout somewhat depressed; lower jaw projecting beyond the upper. The width of the interorbital space is less than one half of the length of the head. The diameter of the eye equals the length of the snout, and is a little less than one third of the length of the head. The origin of the dorsal fin is twice as distant from the eye as from the root of the caudal, and corresponds to the seventeenth scale of the lateral line or to the ninth anal ray. Pectoral fin extending beyond the root of the ventral. None of the fins elongate. Coloration of specimens in spirit uniform reddish olive; a fine bluish line runs along the scales of the lateral line. Several specimens are sent from Fort Johnston; they were collected in November; their length is from 18 to 20 lines. Allied to *Haplochilus Petersii* (Sauvage), but differing in various particulars." (Günther.)

Haplochilus spilargyreus.

Pœcilia spilargyreia Dum., 1861, Arch. Mus., X, 258.
Epiplatys sexfasciatus Gill, 1863, P. Phil. Ac., 1862, 136; Cope, 1871, P. Am. Phil. Soc., XI, 457.
Epiplatys spylargyreia Gill, l. c., 136.
Haplochilus infrafasciatus Gth., 1866, Cat., VI, 313; Sauv., 1880, Nouv. Arch., III (2), 23; Steind., 1893, Notes Leyd. Mus., XVI, 76.
Epiplatys infrafasciatus Cope, 1871, P. Am. Phil. Soc., XI, 457.
Haplochilus spilargyreus Rocheb., 1883, Poiss. Seneg., 139; Sauv., 1880, Nouv. Arch., III (2), 23.

D. 10; A. 14; V. 6; P. 14. (Dum.)
D. 11; A. 14; V. 6; Ll. 28; Ltr. 9. (Gth.)
D. 11; A. 16; Ll. 28–29; Ltr. $8\frac{1}{2}$. (Steind.)

Depth about one fourth, and head near three tenths of the length of the body. Head depressed, snout moderate, lower jaw projecting little beyond the upper. Eye about two sevenths, forehead more than one half, and snout nearly two fifths of the head. Snout as long as the eye, mandible much longer. Dorsal origin midway from eye to end of caudal, opposite the nine-

teenth scale of the lateral line, nearly above the middle of the anal. Dorsal of male reaching the caudal; the anal not. Caudal little longer than the head.

Brownish red; with or without a more or less distinct lateral band of darker, with seven to nine transverse blackish brown bars on the sides, in cases not reaching above the lateral line, anterior one or two indistinct, posterior across the root of the caudal. On many specimens each scale of the upper portion of the body bears a carmine red spot, and dorsal, anal, and caudal are freckled or spotted with the same color.

West Africa. (From literature.)

Haplochilus homalonotus.

Pœcilia omalonota Dum., 1861, Arch. Mus., X, 257, pl. 22, fig. 7; Guich., 1866, Mem. Soc. Cherb., XII, ext. p. 19.

Epiplatys omalonota Gill, 1863, P. Phil. Ac. (1862), 136.

Haplochilus homalonotus Gth., 1866, Cat., VI, 314; Blk., 1875, Poiss. Madag., 101; Sauv., 1891, Poiss. Madag., 485, pl. 47, fig. 2.

D. 11; A. 14; V. 6; P. 14.

Depth of body one fourth and length of head three tenths of the distance from snout to base of caudal. Head and anterior portion of back depressed. Snout little longer than the eye, of medium breadth, blunt. Eye shorter than snout, about two thirds of forehead, two sevenths of head. Dorsal origin half way from gill-opening to end of caudal, opposed to the seventh or eighth ray of the anal. Ventrals small, not reaching the anal. Pectorals reaching behind a vertical from the bases of the ventrals. Caudal convex.

Uniform brownish red.

Nossi-Bé, Madagascar. (Duméril.)

Sauvage says the teeth on each jaw form a single series behind which there are smaller ones irregularly placed. His figure shows the lower jaw to be longer, and the upper to be produced as in Asiatic Haplochili. He finds twenty-eight scales in the lateral line.

Haplochilus nuchimaculatus.

Pœcilia nuchimaculata Guich., 1866, Mem. Soc. Cherb., XII, 143, ext., p. 15.

Haplochilus nuchimaculatus Blk., 1875, Poiss. Madag., 101; Sauv., 1891, Poiss. Madag., 486, pl. 41^{b}, fig. 1.

D. 10; A. 13; Ll. 30.

Body rounded forward, compressed posteriorly; depth one fifth of the total length. Head depressed, crown flat. Eye two thirds of the interorbital space, two sevenths of the head. Lower jaw little longer than the upper. Teeth small, in bands, outer series larger. Dorsal origin midway from the edge of the opercle to the end of the caudal, slightly backward from the middle of the anal. Pectorals terminating far in front of the origin of ventrals, which are small. Caudal rounded, one seventh of the total.

Body brownish, lighter below. Dorsal and anal with brownish dots on a yellowish ground. A large spot of black on the neck.

Madagascar. (Sauvage.)

The published figure of this fish shows the snout to differ from that of the typical Haplochili. The intermaxillaries are apparently similar to those of Fundulus. Nothing is said concerning pseudobranchiæ. Until we know more of its characters the position of this species must remain doubtful.

Haplochilus Dovii.

Haplochilus dovii Gth., 1866, Cat., VI, 316, — 1868, Trans. Zool. Soc., VI, 481, pl. 82, fig. 5; Jor., 1886, P. U. S. Mus., VIII, 368.

Zygonectes dovii Eig., 1893, P. U. S. Mus., XVI, 56.

D. 8; A. 14; V. 6; Ll. 31; Ltr. 8.

Body elongate, depth five, and head three and two thirds times in the length to the base of the caudal. Head long, depressed, with flat crown. Snout long, broad; upper jaw little longer. Eye in the middle of the length of the head, of which it is two ninths, more than half of the interorbital space. Fins well developed; dorsal origin little nearer to end of caudal than to gill opening, above twenty-third scale of the lateral line; anal entirely forward of dorsal and behind the middle of the total length; pectorals reaching the ventrals; ventral reaching the vent; caudal rounded.

Light brownish olive; caudal and inner portions of dorsal and anal with blackish cross bands or series of spots; basal half of caudal with round spots of light color. The specimens described were six inches in length, probably males.

From Punta Arenas, Costa Rica. (Günther.)

RIVULUS.

Rivulus Poey, 1861, Mem., II, 307, 383,—1868, Repert., II, 209, 412; Gthr., 1866, Cat., VI, 327.

Body moderately elongate, depressed anteriorly, compressed in the posterior half. Head depressed, broader than deep, crown flat. Snout short, blunt, rounded. Mouth medium; upper jaw shorter, slightly protractile, not expanded and produced; symphyses rather firm. Teeth small, subconical, in bands. Eyes medium to large, lateral. Gill openings wide; membranes short, partly united, free from the isthmus. Scales thin, flat, striate, covering belly and head, except chin to throat. Intestine short. Ventrals small. Other fins well developed; dorsal and anal behind the middle of the length, former smaller and farther back; caudal broad, convex to pointed. Air bladder present.

Cuba, Central America, and South America from the La Plata northward.

The form is more elongate and the dorsal is farther back, compared with the anal, than in Fundulus. The structure of the mouth differs much from that of Haplochilus, the upper jaw being short and not at all expanded and produced forward. The head has not the compressed appearance, nor the body the depth, obtaining in Cynolebias. And compared with Pterolebias the ventrals are less developed and the caudal section is not so sharp and thin. I find the Rivuli to agree with their kindred in the possession of an air bladder.

Rivulus cylindraceus.

Rivulus cylindraceus Poey, 1861, Mem., II, 308, 383, —1868, Repert., II, 412, —1876, An. Soc. Esp., V, 140, pl. V, fig. 4, — 1880, An. Soc. Esp., IX, 247, pl. VIII, fig. 1; Gthr., 1866, Cat., VI, 327; Jor., 1887, P. U. S. Mus., IX, 564.

Rivulus marmoratus Poey, 1880, An. Soc. Esp., IX; Jor., 1887, P. U. S. Mus., IX, 564.

B. 6; D. 10–11; A. 13; V. 6; P. 14; Ll. 38–39; Ltr. 11–12; Vert. 15+17.

In this species the form is moderately elongate, compressed behind the body cavity, depressed anteriorly, and little, if any, more nearly cylindrical around the middle than some of the other types. Depth about two ninths of the total length. Head broad, flattened on the crown, three and a half times in the length, without the caudal. Snout broad, blunt, hardly as long as the eye. Mouth moderate, superior in aspect, cleft nearly horizontal; jaws somewhat firmly united. Teeth simple, hooked, firmly set,

outer series larger and in open order, inner small, in bands. Eye large, nearly four and a half times in the head, twice in the interorbital space. Scales large, thin. Dorsal fin small, base originating near two thirds of the distance from the occiput to the caudal, over the middle of the anal, and extending back about as far as that of the last, varying in position in individuals. Ventrals very small, not reaching the anal. Pectorals small, reaching more than half way to the ventrals. Caudal large, fan shaped, rounded on the margin, scaly on the base.

Olivaceous, uniform or with darker mottlings or cloudings, centres of scales darker; fins more or less clouded with fine puncticulations, sometimes tipped with darker; an ocellate spot of black on the bases of the caudal rays in the upper half of the fin. The females examined measure one and six tenths inches, the males but one and one tenth.

Cuba.

Rivulus brasiliensis.

Plate III. Fig. 12, teeth.

Fundulus brasiliensis Val., 1828, Humb. Obs. Zool., II, 163, pl. LII, fig. 2, —1846, C. V., Poiss., XVIII, 199, —1840, R. An., ed. Ill., Poiss., 228, pl. 95, fig. 3; Wagn., 1828, Isis, XXI, 1056; Guer., 1838, Icon. R. An., Poiss., 29, pl. 48, fig 3; Blkr., 1860, Cypr., 486.

Haplochilus brasiliensis Gthr., 1866, Cat., VI, 317.

Rivulus urophthalmus Gthr., 1866, Cat., VI, 327; Eig., 1891, P. U. S. Mus., XIV, 64, —1894, Ann. N. Y. Ac., VII, 629.

Rivulus Poeyi Steind., 1876, Sb. Ak. Wien, LXXIV, extr. p. 117; Eig., 1891, l. c., 64.

B. 6; D. 6–7; A. 12–13; V. 6; P. 14; Ll. 42–43; Ltr. 10–11; Vert. 15+19.

Moderately elongate, compressed toward the tail, depressed on head and nape, depth one fifth of the length without the caudal. Head two ninths of the length to the tail, broad, flattened on the crown. Snout shorter than the eye, bluntly rounded. Mouth medium, nearly horizontal in the cleft, lower jaw prominent. Teeth subconical, hooked, outer series larger, in open order, inner smaller, in bands. Eye large, one fourth of head, one half of interorbital space. Dorsal small, origin three fourths of the distance from eye to base of caudal, extending above several of the hindmost rays of the anal (varying in this respect in individuals). Ventrals very small, not reaching the anal. Pectorals small. Caudal as long as the head, rounded on the margin.

Olivaceous to brownish or reddish, with a lighter dark edged band on the back, possibly lost with age, clouded more or less on the flanks. Belly

lighter, as also lower surface of head. Centres of scales darker. Dorsal and caudal with transverse series of small spots, often irregular, sometimes absent. An ocellate spot on the bases of the caudal rays in the upper half of the fin is not always present. Pectoral and anal somewhat clouded in large specimens. Top of head between the eyes darker. Longest example one and three eighths inches.

Para; Gurupa.

Rivulus micropus.

Plate III. Fig. 13, teeth.

Fundulus micropus Steind., 1863, Sb. Ak. Wien, XLVIII, 184.

Rivulus micropus Gthr., 1866, Cat., VI, 327; Cope, 1878, P. Am. Phil. Soc., XVII, 695; Jor., 1887, P. U. S. Mus., IX, 564; Eig., 1891, P. U. S. Mus., XIV, 64.

Rivulus (*Fundulus*) *micropus* Steind., 1880, Denk. Ak. Wien, XLII, 86.

Haplochilus Hartii Blgr., 1890, Ann. Mag. Nat. Hist., (6) VI, 190.

B. 6; D. 8–9; A. 14–15; V. 6; P. 13–15; Ll. 42–44; Ltr. 11; Vert. 14 + 18.

Form rather elongate, compressed backward, depressed from the shoulders forward, depth about two ninths of the length to the caudal. Head broad, flattened on the crown, five and a half times in the length with the caudal or four and a half without it. Snout broad, rounded, hardly as long as the eye. Eye large, three and a half times in the head, twice in the forehead. Mouth medium, nearly horizontal; upper jaw shorter; symphyses firm. Teeth simple, pointed, hooked, outer series larger, not in contact; inner in bands. Dorsal small, origin above hind part of anal, three fourths of the distance from the snout to the base of the caudal. Anal larger, base extending farther forward than that of dorsal and nearly as far backward. Caudal broad, fan-shaped, regularly rounded, as long as head. Ventrals small. Pectorals not large, with rounded margins.

Olivaceous, darker on back and top of head, lighter to whitish beneath. Centres of scales on flanks darker. Fins lighter with darker edges. Lower lip darker. Dorsal fin with vermiculations or irregular series of small spots, or uniform. Caudal in many cases with white edge above and below, occasionally a black blotch in the white. Specimens of less than two inches are lighter colored and have a light band more or less marked by blotches along the back, while the dark in the middle of each scale on the flank forms vittæ; a dark spot surrounded by white on the upper portion of the base of the tail is not rare. As the individual grows darker the spot is undistinguishable. Largest example three and one eighth inches.

Trinidad; Rio Negro.

Rivulus ocellatus.

Rivulus ocellatus Hens., 1868. Wiegm. Arch., XXXIV, 365, — 1869, l. c., XXXV, 89; Eig., 1891, P. U. S. Mus., XIV, 64.

D. 9; A. 11; C. 17; Ll. 39.

Die Unterkiefer, fest vereinigt. Die vordere Zahnreihe besteht aus grossen spitzen Zähnen, die nach hinten gebogen und weiss oder nur an der Spitze kaum merklich gelblich sind. Sie stehen sehr weitläufig, und ihre Zahl beträgt in jedem Unterkiefer fünf bis sechs, im Zwischenkiefer weniger. Hinter ihnen sind mehrere Reihen kleiner hechelförmiger Zähnchen. Die Augen sind gross, ihr Durchmesser beträgt ungefähr $\frac{3}{4}$ des Abstandes der Augen von einander. Die Mundöffnung ist diesem fast gleich, und grösser als bei *Pœcilia unimaculata*. Das Maul ist vorstreckbar, die Länge der Pectoralflossen verdoppelt, erreicht den Ursprung der Analflosse. Die Ventralflossen sehr klein, erreichen mit ihren Spitzen den After. Der Ursprung der Dorsalflosse in der Verticallinie des Endes der Basis der Analflosse. Der Ursprung der Dorsalflosse ist von der Kiemenöffnung ungefähr um das Doppelte der Kopflänge, von der Caudalflosse um die Kopflänge selbst entfernt, der erste Strahl in der Dorsal- und Analflosse ist sehr klein und leicht zu übersehen. Die Caudalflosse hat 17 grössere und einige ganz kleine Strahlen. Die Farbe (in Spiritus) ist gelblich graubraun, nach dem Rücken zu dunkler als an der Unterseite. An der Schulter über dem Ursprunge der Pectoralflosse befindet sich ein dunkler Fleck ungefähr von der Grösse des Auges, ein anderer, kleinerer, an der Basis der Caudalflosse, oberhalb der Mittellinie der Seite nahe dem oberen Rande, ein noch kleinerer etwas undeutlicher genau in der Mittellinie der Seite an der Basis der Caudalflosse. Die Dorsal- und Caudalflosse, welche an ihrer Basis mehrfache Reihen kleiner Schuppen hat, sind undeutlich gefleckt. Eine Untersuchung der Eingeweide hat nicht stattgefunden.

Die Länge des einzigen Exemplares welches bei Rio de Janeiro in Gesellschaft der Pœcilien gefangen wurde, ist 37 mm. (ohne Schwanzflosse). (Hensel.)

The differences indicated by this description are hardly sufficient to establish the species as distinct from *R. brasiliensis*.

Rivulus Balzanii.

Haplochilus Balzanii Perugia, 1891, Ann. Mus. Civ., (2) X, 653; Eig., 1893, P. U. S. Mus., XVI, 54.

D. 9; A. 14; Ll. 34; Ltr. 10.

L' altezza del corpo forma circa il quarto della lunghezza. Il capo è molto depresso e sua lunghezza è il terzo del corpo.

L' occhio è grande, il suo diametro è di poco più della metà dello spazio interorbitale ed è contenuto 3 volte nella lunghezza del capo.

La dorsale ha origine sopra il settimo raggio anale, è uguale in altezza a questa ed entrambi chiuse e piegate all' indietro arrivano alla base della caudale.

Il colore è bruno al capo, i fianchi giallastri con 4 a 5 fascie longitudinali brune, ognuna delle quali occupa l' altezza di una squama. Dorsale ed anale chiare, con tre serie regolari di macchie brune. Le altre pinne immacolate.

Villa Maria (Matto Grosso), Rio Paraguay, Prof. Balzan. (Perugia.)

Rivulus elegans.

Rivulus elegans Steind., 1880, Denk. Ak. Wien, XLII, 85, extr. p. 33, pl. VI, fig. 6; Jor., 1887, P. U. S. Mus., IX, 564; Eig., 1891, P. U. S. Mus., XIV, 64.

D. 7–8; A. 13–15; Ll. 35–36 (bis zum Beginne der Caud.).

Körperform stark verlängert; Kopf deprimirt, an der Oberseite fast vollkommen flach, seitlich schwach gewölbt. Kopflänge mehr als $3\frac{1}{2}$ — nahezu 4 mal, grösste Rumpfhöhe $4\frac{1}{3}$ — $5\frac{1}{3}$ mal in der Körperlänge. Augendiameter je nach dem Alter $2\frac{2}{3}$ mal (bei jüngeren Individuen) bis $3\frac{1}{3}$ mal, Stirnbreite $1\frac{3}{4}$ — 2 mal, Schnauzenlänge weniger als 4 mal in der Körperlänge enthalten. Dorsale in verticaler Richtung ein wenig vor dem hinteren Basisende der Anale beginnend, von geringer Basislänge, doch verhältnissmässig hoch; Anale vielstrahlig, lang; Ventralen klein; Caudale am hinteren Rande schwach gerundet oder vertical abgestutzt. Körperfärbung variabel, an der Oberseite dunkel violett oder dunkelbraun, seitlich heller violett oder bräunlich, an der Bauchseite und gegen den Schwanzstiel zu hell gelbbraun, gelblichweiss oder perlgrau. Ein rothgelber Fleck im Centrum fast jeder Rumpfschuppe in den beiden oberen Dritteln der Rumpfhöhe; zuweilen fleissen diese Flecken mehr oder minder vollständig zu Längsreihen zusammen, die dann mit dunkleren, schmäleren Binden oder Streifen (von der Grundfarbe des Rumpfes) alterniren. Dorsale mit zahlreichen kleinen, dunklen Fleck-

chen besetzt, zuweilen auch die Caudale. Die übrigen Flossen stets ungefleckt; Caudale am hinteren Rande zuweilen (bei Männchen) breit, weisslich gesäumt und in der vorderen Hälfte stets dicht überschuppt. 35–36 Schuppen zwischen dem oberen Ende der Kiemenspalte und dem Beginne der Caudale in einer Längsreihe und $11\frac{1}{2}$ zwischen der Mittellinie des Rückens und der Basis des äusseren Ventralstrahles in einer Querreihe.

Cauca. (Steind.)

Closely allied to *R. micropus*, of which it may yet prove to be a variety.

Rivulus ornatus sp. n.

B. 6–5; D. 6; A. 10–11; V. 6; P. 12–14; Ll. 31; Ltr. 8.

Shaped like the majority of the species in the genus. Head one fourth of the length to the base of the caudal, broad, flattened on the crown, depressed. Snout broad, rounded, about as long as the eye. Eye one fourth of the head, one half of the interorbital space. First ray of dorsal above last of anal, two thirds of the distance from the base of the pectoral to the base of the caudal, or three fourths of that from the front edge of the eye to the caudal. First ray of anal half way from head to base of caudal. Ventrals small, not reaching the anal. Pectorals elongate, as long as the head, reaching nearly to the ventrals. Caudal elongate, pointed.

The markings of this fish are made up of puncticulations; they form transverse blotches along the back, streaks along the sides, series of dots across the fins, a dark band on the lower lip, and a dark streak backward from below each eye. In cases light bands on the back meet dark vertical bars on the flank. Some specimens are dark brownish, others very light. A few are quite dark on the back. The longest measure one and three eighths inches.

Silva; Cudajas; Lago Alexo; Lake Hyanuary.

The formula D. 6; A. 8; P. 12; Ll. 26; Ltr. 6, is taken from an individual resembling the preceding in position of dorsal and anal, but lacking the blotches and bearing a streak from occiput to caudal and another from anal to caudal. Other collections may prove this to belong to a distinct species. It was obtained in Lago Alexo.

Rivulus isthmensis sp. n.

D. 9; A. 11; V. 6; P. 15; Ll. 32; Ltr. 8.

Elongate, compressed posteriorly, depressed forward. Head broad, much depressed, flattened on the crown, three tenths of the length without the caudal. Snout medium, blunt, half as long as the eye. Eye one third of the head, twice the snout, less than the interorbital space. First ray of the dorsal over the middle of the base of the anal, two thirds of the distance from the head to the base of the caudal. First ray of anal midway from head to caudal, last ray nearly as far back as that of the dorsal. Caudal elongate, pointed, as long as the head.

Light olivaceous, with a dark blotch at the base of the dorsal and another on the back above or in front of the first ray of the anal. Apparently there is a light transverse streak at the base of the caudal.

Rio San José, Costa Rica.

Rivulus obscurus sp. n.

D. 6; A. 8; V. 6; P. 12; Ll. 29; Ltr. 8.

Moderately slender, shaped like *R. cylindraceus*. Head broad, flat on the crown, much wider than deep, three elevenths of the length to the caudal. Snout broad, blunt, rounded, little more than half as long as the eye. Mouth wide, lower jaw longer, upper short. Eye large, one third of the head, twice the snout, two thirds of the interorbital space. Origin of dorsal behind the base of the anal, three fourths of the distance from the middle of the eye to the base of the caudal. Origin of anal half way from head to caudal; about one half of the base is in front of that of dorsal. Ventrals small, hardly reaching the anal. Caudal long, pointed, longer than the head.

Light brownish on the back; with or without brownish blotches, among which, on each side of the vertebral line, there is a series of three or more light blotches. Snout whitish on the top; occiput dark.

Lake Hyanuary.

Rivulus atratus sp. n.

B. 5; D. 6; A. 9–10; V. 6; P. 11; Ll. 31; Ltr. 7.

Elongate, rather slender, depressed forward, compressed behind the vent somewhat less than in any of the other species, depth about one sixth of the

length to the caudal. Head one and one half times the depth, two thirds as broad as long, flattened on the crown. Snout very broad, rounded in front, two thirds as long as the eye. Mouth wide, intermaxillary slightly protractile, symphyses firm. Teeth simple, hooked, outer separated, larger, inner in bands, smaller, pharyngeal stouter, larger, a few stout with cusps ground off like molars. Eye large, two sevenths of the head, half of the interorbital space. Dorsal small, origin three fourths of the distance from the occiput to the base of the caudal, base its length farther back than that of anal. Anal larger, farther forward than dorsal. Ventrals very small, not reaching the vent, sometimes absent on one side. Pectoral elongate, pointed, nearly as long as the head. Caudal one and one half times the length of the head, or longer, median rays longest, acute pointed. Scales large.

Brownish; blackish at the lower edge of each flank and below the caudal pedicel. Black bands from the chin meet at the anal fin. Occasionally the entire lower surface is blackish. A broad dark band reaches up the sides behind the pectorals, another between the ventrals and the anal, and a third from the ventral surface to the base of the dorsal. A dark band from eye to eye around the chin; behind this a whitish streak. The dark color is on the centres of the scales, which produces the appearance of vittæ. Fins brownish, clouded or banded, darker toward the ends. Top of snout lighter in color. The vertical bands grow fainter with age. In shape this species approaches Anableps.

Jutahy.

PTEROLEBIAS.

In the species upon which this genus is founded the body is much compressed, the caudal section especially being deep, thin, and blade-like at the lower edge. A transsection of the middle of the head is a sub-quadrate. The snout is short and blunt, the chin steep, and the mouth has an oblique cleft, as in Orestias. The lower jaw is the more prominent, the upper is somewhat protractile, and the symphyses are firm. The teeth are small, subconical, in bands, and the pharyngeal have a shoulder. Gill openings wide; gill membranes short, partly united, free from the isthmus. Fins pointed; fin rays elongate. Dorsal short, its origin behind that of anal. Anal long. Pectorals and ventrals of medium size. Lateral line distinct. Body cavity nearly half the length of the body, without the caudal.

The proper place for this genus is between Rivulus and Cynolebias.

From the former it differs in the long anal fin, the deep caudal pedicel, and the sharp compression between ventrals and caudal; while it is distinguished from the latter by the short dorsal, its posterior position, and the depth and compression of the hinder portion of the body. The structure of the jaws and mouth remove it entirely from Haplochilus.

Pterolebias longipinnis sp. n.

Plate III. Fig. 14, teeth.

B. 6; D. 10–9; A. 20–19; V. 8; P. 16–15; Ll. 31–32; Ltr. 10–11; Vert. 15 + 16.

Body of moderate length, depth three and two thirds times in the length, without the caudal; caudal portion deep, thin, sharp at the lower edge. Head depressed, crown flattened, three and one half times in the length to the caudal fin. Snout short, half as long as eye, curved from orbit to orbit. Eye large, less than three times in head, one and one half times in forehead, longer than snout. Mouth wide, extending close to the eye, oblique; symphyses firm; lower jaw prominent, upper short not very protractile. Mandibles comparatively long. Teeth subconical, hooked, in bands, outer series larger, in open order. Pharyngeal teeth resembling the maxillary but stouter, some usually worn off on the tops like molars. Scales large; lateral line distinct. Fins elongate, varying much in shapes among individual specimens, bases scaly. Dorsal small, pointed, first ray four fifths of the distance from snout to caudal, above fourteenth ray of anal. In cases some of the rays are nearly as long as the head and extend upon the caudal. Anal long, deep, reaching the caudal, pointed behind, rounded below. Ventrals narrow, anterior rays near half as long as body without head or caudal, with the filamentary prolongation, reaching hind end of base of anal; bases under mid-length of pectorals in males, and under their tips in females. Caudal broad, pointed, long, in one case as long as the body without the caudal or head.

Females of one and three-fourths inches with fully developed ova.

Olivaceous or brownish, darker on chin, back, and edges of fins. All fins with small spots in transverse series, fainter on ventrals and anal. Ventral surface little lighter. Largest specimen three and two tenths inches in length, one and three tenths of this being caudal. Santarem.

CYNOLEBIAS.

Cynolebias Steind., 1876, Sb. Ak. Wien, LXXIV, extr. p. 124.

Head and body compressed, body deep, caudal pedicel medium. Chin steep, lower jaw massive, prominent, symphyses firm. Teeth subconical, in bands. Gill openings wide; membranes short, united for a short distance, free from the isthmus. Dorsal and anal with numerous rays, opposed, anal longer and originating a trifle farther forward. Ventrals small, bases near anal. Body cavity hardly half of the length to the caudal.

Body and head are both more compressed in this genus than in Rivulus; the body is deeper in the forward half and rather more slender in the caudal section; the fin rays are more numerous, and the base of the dorsal is longer. Compared with Pterolebias the body is deeper forward and has not the sharp edge between ventrals and caudal. The head also is more compressed, the snout longer, and the mouth more nearly horizontal. Four species have been described from La Plata river, and one from Pernambuco; of the five it does not appear that more than three are valid.

		Page
Cheek, preopercular, scales in six or more series;		
Ll. more than forty	*porosus*	143
Cheek scales in two or three series;		
Ll. less than thirty-five;		
anal rays more than twenty-five	*Bellottii*	144
anal rays less than twenty-five	*maculatus*	145

Cynolebias porosus.

Cynolebias porosus Steind., 1876, Sb. Ak. Wien, LXXIV, extr. p. 125, pl. 10. fig. 3; Perug., 1891, Ann. Mus. Civ. Gen., (2) X, 651; Eig., 1891, P. U. S. Mus., XIV, 65.

Cynolebias elongatus St., 1881, Denk. Ak. Wien, XLIV, extr. p. 11; Eig., 1891, P. U. S. Mus., XIV, 64.

B. 7; D. 17–18; A. 20; V. 5; P. 14; Ll. ca. 45–48; Ltr. 21.

Body compressed, depth at origin of dorsal nearly equal length of head, equal three tenths of the body without the caudal, or little more than one fourth of the total length. Back arched from head to hind end of dorsal. Pedicel of caudal medium. Head compressed, crown flattened, cheeks covered with scales, chin and throat naked. Eye small, lateral, hardly as long as snout, two ninths of head, one half of forehead. Anterior nostril a short tube. Mouth nearly horizontal; lower jaw longer, massive; chin steep;

symphyses firm. Teeth subconical, in bands, outer series larger. Base of dorsal not quite as long as that of anal, originating midway from opercle to base of caudal, above the fourth anal ray. These positions vary with individual or sex. Pectoral medium, fin reaching behind origin of anal. Ventrals small, close to anal. Caudal rounded, its length about five eighths of that of head. The longest rays of dorsal and anal appear at the beginning of the hindmost third or fourth of the fin, from these they decrease to less than half as long at the ends.

Dull reddish brown, belly yellowish white. Dorsal and anal grayish toward outer margins. La Plata specimens are yellowish brown with a number of not well defined dingy bands across the flanks. Attains a length of four inches or more. Pernambuco to La Plata River.

Cynolebias Bellottii.

Cynolebias Bellottii Steind., 1881, Denk. Ak. Wien, XLIV, extr., p. 9, pl. 5, fig. 3; Perug., 1891, Ann. Mus. Civ. Gen., (2) X, 651; Eig., 1891, P. U. S. Mus., XIV, 64.

D. 23; A. 28–29; V. 5; Ll. 30; Ltr. ca. 14.

Body compressed, greatest depth three eighths, and length of head two sevenths times in the length of the body. Diameter of eye three and three fifths times, and width of forehead little more than twice in the length of the head. Crown slightly arched; back more curved from head to dorsal. Mouth broad, nearly horizontal; jaws firm, lower prominent, massive, upper somewhat protractile. Teeth small, in bands, outer series larger, in open order. Anterior nostrils tubular. Snout short, blunt, subtruncate. Head covered with scales, except on snout and chin to throat. Origin of dorsal little nearer to the snout than to the bases of the median caudal rays, a little behind the origin of the anal; dorsal rays increasing in height to the thirteenth, which is nearly two thirds of the length of the head. Anal reaching its greatest depth in the eighth or ninth rays, which are about two thirds of the length of the head. Pectorals well developed, rounded, one third longer than the head, reaching the origin of the anal. Ventrals near the anal, one third of the length of the pectoral. Caudal as long as the pectoral, rounded.

Head and body dull brownish; caudal, anal, dorsal, and ventral olivaceous. Pectorals dull brownish gray, lower edge lighter. A dark band from the back of the head obliquely forward and downward through the eye.

La Plata.

Cynolebias maculatus.

Cynolebias maculatus Steind., 1881, Denk. Ak. Wien, XLIV, extr. p. 9, pl. 5, fig. 3; Perug., 1891, Ann. Mus. Civ. Gen., (2) X, 651; Eig., 1891, P. U. S. Mus., XIV, 65.
Cynolebias robustus Gthr., 1883, Ann. Mag., (5) II, 140; Perug., l. c., 651; Eig., l. c., 65.

D. 17–20; A. 22–23; V. 9; P. 13; Ll. 30–35; Ltr. ca. 14.

Shape similar to that of the preceding; dorsal and anal shorter and farther from the head. Greatest depth, about the middle, over the ventrals, two and two thirds times in the length without the caudal, equal one and one third times the length of the head. Head three tenths of the body without the caudal, its greatest width one and two fifths times in its length. Eye nearly four times in the head, twice in the forehead. Mouth horizontal, maxillary reaching below anterior margin of eye; lower jaw prominent, bulky; symphyses firm. Anterior nostril tubular. Snout blunt, as long as eye. Teeth in bands, subconical, hooked, outer series larger. Origin of dorsal about midway from opercle to base of caudal; origin of anal little farther forward. Pectoral not quite as long as head, not reaching anal. Ventrals near the anal, close together, larger than those of *C. Bellottii*.

Violaceous to brown, with or without small spots of brownish in more or less irregular series; smaller spots on dorsal and anal. Apparently the colors darken, and the spots are lost with age. A dark band through the eye, as in *C. Bellottii*, is present on the maculate specimens, which suggests a closer relationship between these species than we are at present able to establish. Günther's specimen measured three and three fourths inches.

La Plata.

ORESTIAS.

Plate III. Fig. 9–11, teeth.

Orestias Valenciennes, 1839, L'Institut, VII, No. 276, 118, — 1846, C. V. Hist. Poiss., XVIII, 221; Dum., 1856, Ichth., 226, 441; Blkr., 1860, Ind. Cypr., 483, — 1863, Atl. Ichth., III, 140; Gthr., 1866, Cat., VI, 328, — 1880, Intr., 615. *Orestiasini* Blkr., 1860, Ind. Cypr., 483. *Orestiasiformes* Blkr., 1863, Atl. Ichth., III, 140. *Orestiinæ* Gill, 1894, Mem. Nat. Acad., VI, 133.

Excepting the absence of the ventral fins, in this genus young specimens, up to medium size, resemble Funduli; on larger ones of some species the head becomes swollen and angular, and bears a likeness to Uranoscopi. The mouth is directed upward, and varies from small to large; the lower jaw is prominent, the upper protractile. All of the teeth are small, subconical, and hooked; on the jaws they are placed in a single series or in a narrow band;

on the pharyngeals they form a card, and have a slight shoulder, as in Rivulus. The gill membranes are partly united, but free from the isthmus. Normally there are five branchial rays. In cases the length of the intestine about equals the total length of the fish; from this it varies to nearly twice as long; the stomach is but little differentiated. On the young generally, and throughout life on a few species, the scales are thin and striate; later stages of particular types are marked by a thickening and enlargement of the scales on the anterior portion of the body and head, which scales are in some species tubercular or granulated, or in others smooth and polished. A medium size obtains in the fins; dorsal and anal are behind the middle of the body, opposed, and the latter is unmodified in the male; there are no traces of ventrals.

The genus inhabits the freshwaters of the upper Andes of South America, especially Titicaca and similar bodies. In these isolated lakes Orestias and a siluroid, Trichomycterus, are so far as known the only genera. Their food is mostly animal. Whether the vegetation of these waters, abundant — such as it is — is at all fit for a vegetable-eating fish, like the carp, can be determined only by an experiment in fish culture, for which it appears as if a grand opportunity is here provided. Valenciennes, in 1839, named this genus, from the Greek word ὀρεστιάς, a nymph of the mountains, on page 118 of the journal L'Institut, where he mentions the lack of ventral fins, and enumerates several of the species with their localities and vernacular designations.

Young individuals of all the species are much alike, even those which become very distinct in their later stages; for this reason a synopsis that serves to separate large individuals of the different types is of less value when applied to the small ones. The following includes the species recognized in these pages.

		Page
Elongate, in adult;		
scales granulate;		
mouth large; teeth many	*Cuvieri*	147
mouth small; teeth few	*Pentlandii*	148
scales striate; mouth small	*elegans*	149
Medium;		
scales striate; crown flat; mouth large	*Mülleri*	149
scales smooth, in part; crown convex; mouth small	*Agassizii*	150
Short; belly naked;		
body rounded; head rounded;		
mouth small; scales striate	*olivaceus*	152

		Page
body compressed; head angular		
scales granulate, in part;		
snout large; mouth wide	*albus*	153
snout narrow; mouth small	*luteus*	154
scales smooth, in part; back high	*Jussieui*	155
Short; belly covered with scales;		
body much compressed	*Incæ*	155

Orestias Cuvieri.

Plate III. Fig. 11, teeth.

Orestias Cuvieri Val., 1839, L'Inst., VII, 118, — 1846, C. V. Poiss., XVIII, 225, pl. 532; Blkr., 1860, Ind. Cypr., 487, — 1863, Atl. Ichth., III, 140; Gthr., 1866, Cat., VI, 328; Garm., 1876, Bull. M. C. Z., III, 276; Eig., 1891, P. U. S. Mus., XIV, 65.

Orestias Humboldtii Val., 1839, L'Inst., VII, 118, — 1846, C. V. Poiss., XVIII, 233, pl. 534; Blkr., 1860, Cypr., 487.

Orestias Pentlandi Cast., 1855, Exp. Am. Sud, Poiss., 52, pl. 27, fig. 2.

B. 5; D. 15–16; A. 17–18; P. 18; Ll. 41–43; Ltr. 13–16; Vert. 14 + 20.

Body elongate, slightly compressed; caudal pedicel rather slender, broadening at base of the fin. Head large, one third of length, without caudal; crown broad, depressed and concave at occiput and snout, flattened in the middle. Snout large, broad, blunt, rounded, nearly twice as long as eye; chin vertical. Mouth wide, oblique, cleft reaching below the lower level of the orbit. Teeth strong, in bands, numerous, hooked, subconical. Eye medium, about half the length of the snout, one sixth of that of the head, and three fifths of the width of the interorbital space. Scales of head and shoulders granular; a series of about twenty large vertebral scales, in front of the dorsal; scales of the lateral line larger than those on each side of it; belly scaleless. On young individuals all the scales are flat, thin, and concentrically striate; the granulation and thickening appear first at the head then gradually extend farther back. Dorsal origin near half way from head to caudal; fin low, rounded on upper margin, third ray above origin of anal. Anal extending a little farther back than dorsal, in base and fin. Pectorals about the size of anal, reaching half way to the vent. Caudal broad, hinder margin concave, more deeply indented in the young. Specimen described ten and a half inches in length.

Brownish on back, lighter on flanks, centres of scales lighter; white beneath; fins clouded with brownish; young with blotches and spots on the upper surface, and several series of small spots across dorsal and caudal.

The shape of the head, massive snout, large mouth, numerous teeth, and larger scales readily distinguish this species from its nearest ally *O. Pentlandii.*

Common in Lake Titicaca.

Orestias Pentlandii.

Orestias Pentlandii Val., 1839, L'Inst., VII, 118, — 1846, C. V. Poiss., XVIII, 230, pl. 533; Blkr., 1860, Ind. Cypr., 487; Gthr., 1866, Cat., VI, 329; Cope, 1875, Jour. Phil. Ac., 185; Garm., 1876, Bull. M. C. Z., III, 275; Eig., 1891, P. U. S. Mus., XIV, 65, — 1894, Ann. N. Y. Ac., VII, 629.

Orestias Bairdii Cope, 1875, J. Phil. Ac., 185; Eig., 1893, P. U. S. Mus., XVI, 54.

B. 5 (rarely 6); D. 13–15; A. 15–18; P. 19–20; Ll. 55–63; Ltr. 15–18; Vert. 16 + 21 or 17 + 20.

Body elongate, moderately compressed; caudal pedicel slender, broadening at base of fin. Head one fourth of the length, without the caudal, broad and convex on the crown, narrowing toward the snout. Snout medium, little longer than the eye, rounded, blunt; chin vertical. Mouth medium, not reaching downward to the level of the lower edge of the orbit, nearly vertical. Teeth few, lacking the band of smaller ones behind the outer row, easily lost. Eye shorter than snout, two-elevenths of head, four-ninths of interorbital space. Origin of dorsal half way from occiput to caudal, little forward of that of anal, fin rounded above, forming an angle in the posterior rays. Pectorals moderately broad, reaching two fifths of the distance to the anal. Caudal three fifths the length of head, hinder margin slightly concave. Scales thin, somewhat deciduous, one to three vertebral rows larger, about twenty seven from head to dorsal, with age becoming thickened and rugose or smooth on head and shoulders and to some extent backward along the flanks, the hard enlarged series occasionally extending quite to the base of the tail. Belly naked, as also an area along the sides of the anal and behind it, or another at each side of the vertebral series of scales.

Back brownish, sides lighter to silvery, in lower half, ventral surface white. Young mottled and blotched on the back. Dorsal and caudal brownish, with or without small spots of brown, that sometimes form transverse series. Fins in cases brownish toward the outer edges. Pectorals brownish in upper half, white in lower. Very common in Lake Titicaca. Specimens from the Cuzco Valley are about two thirds as large as those described; they are much darker on the back, above the lateral line, and apparently belong to a distinct variety, *fuscus*.

Orestias elegans sp. n.

B. 5; D. 15; A. 16; P. 16–18; Ll. 34–36; Vert. 14 + 18.

Compared with that of *O. Agassizii* the body is more elongate and less compressed, the crown between the eyes is more convex, and the eyes are smaller. Head three and three fourths, and height four times in the length to the caudal. Eye as long as the snout, four fifteenths as long as the head, as wide as the interorbital space. Mouth vertical, cleft not reaching the level of the lower edge of the orbit. Teeth in a single series. Dorsal originating midway from eye to caudal and distant the length of its base from the latter. On the male anal and dorsal, toward their extremities, are laterally beset with small sharp spines. Caudal about four-fifths as long as the head, convex on its posterior margin. In a female of two and one-eighth inches the eggs are nearly mature. Scales medium, flat, so thin as to be hardly visible, apparently lost at each side of the vertebral series.

Light brownish, yellow tinted, lower half silvery, top of head dark; a silvery band along the side, in cases longitudinally bisected by a dark streak; thickly freckled with small spots of brown; larger blotches on the dorsum, becoming more distinct and vertically elongate at each side of the dorsal fin and above the caudal pedicel; five or six narrow wavy transverse streaks of brown on the caudal fin, and two or three similar ones on the dorsal. This is at present the smallest known species of the genus. It was taken in small lakes among the head waters of the Rimac river, Peru: "Lagunas de la Cordillera de la Ascension, orígen del rio de Santa Eulalia que se reune con el rio Rimac que pasa por Lima, 4200 metros."

Orestias Mülleri.

Orestias Mülleri Val., 1846, C. V. Poiss., XVIII, 240; Blkr., 1860, Cypr., 487; Garm., 1876, Bull. M. C. Z., III, 276.

Orestias luteus Gthr., 1866, Cat., VI, 331.

B. 5; D. 12–13 · A. 13–14; P. 17–19; Ll. 38–42; Ltr. 16–17; Vert. 14 + 18.

Body moderately compressed; back not high, but arching regularly from head to dorsal; caudal section compressed, slender, deepening considerably at base of caudal fin. Head large, as broad as high, one third of the length to base of caudal, crown flattened, orbits prominent above. Snout shorter than eye, broad, blunt, rounded, not bent upward as in *O. Cuvieri*. Mouth

oblique as in *O. Cuvieri*, but intermediate in size between that species and *O. Pentlandii*. Tongue with papillæ resembling small teeth. Eyes large, orbit extending above level of crown, longer than snout, little less than one third of head, nearly equal to interorbital space. Bases of dorsal and anal short, about twice their lengths from the caudal, prominent beyond outline of body. Caudal moderately long, subtruncate, conspicuously wider than caudal pedicel, which has a more slender appearance than in other species. Scales medium, regularly placed, thin, flat, not granulate, with very fine striæ, those along the vertebral line small, irregular and showing a slight indication of a vertebral keel. Belly appearing naked, but seen under the lens to be nearly covered by smaller scales. Entire space below orbit to preorbital covered with scales.

Entire body light olivaceous brown to yellowish; sides below lateral line, belly, cheeks, and throat somewhat silvery. Back above lateral line brownish, freckled with faint spots of rusty brown. Dorsal and caudal with irregular transverse series of brownish spots. Young similar in markings, bearing a dark streak in a silvery band along the flank, and more of the silvery tint on cheeks and beneath. Largest specimen at hand three and three fourths inches.

Lake Titicaca.

Orestias Agassizii.

Plate III. Fig. 10, teeth.

Orestias Agassii Val., 1846, C. V. Poiss., XVIII, 238, pl. 536; Blkr., 1860, Cypr., 487.
Orestias Agassizii Garm., 1876, Bull. M. C. Z., III, 275; Eig., 1891, P. U. S. Mus., XIV, 65, — 1894, Ann. N. Y. Ac., VII, 629.
Orestias Tschudii Cast., 1855, Exp. Am. Sud, Poiss., 51, pl. 27, fig. 1; Blkr., 1860, Cypr., 487.
Orestias Owenii (part) Gthr., 1866, Cat., VII, 330.
Orestias Ortonii Cope, 1875, J. Phil. Ac., 186; Eig., 1893, P. U. S. Mus., XVI, 54.
Orestias frontosus Cope, 1875, l. c., 187; Eig., 1893, l. c., 54.

B. 5; D. 14–15; A. 16–17; P. 17–18; Ll. 34–36; Ltr. 14–15; Vert. 15 or 14 + 18.

Body rather elongate and compressed, not rising so high above the pectorals as in *O. Jussieui*, not angular. Head short, less than depth, four and one fourth times in the length without caudal, rounded on all sides, interorbital space much arched both longitudinally and transversely. Snout medium, longer than eye, narrow, blunt, rounded; chin nearly vertical. Mouth narrow, vertical, cleft extending a little below the lower level of the eye. Teeth small, simple, hooked, inner series smaller; pharyngeal

teeth with a shoulder, as in Anableps and Rivulus. Eye one and one-half times in the snout, twice in the interorbital space, and four and three fourths times in the head. Scales large; on head and body to tips of pectorals thick, convex, smooth, and glossy; on hinder portion of body flat, thinner, with fine striæ, not glossy; breast naked, more of the lower surface covered on this species than on *O. Cuvieri* or *O. Pentlandii;* about four series of scales on the cheek; more or less of the top of the snout naked; vertebral series irregular. Dorsal fin originating about half way from occiput to base of caudal, its third ray above the first anal ray, which is midway between base of pectoral and caudal. Base of anal extending a couple of rays farther backward than that of dorsal. Caudal broad, as long as head, rounded on the posterior margin. Pectorals reaching little more than half the distance to anal. Intestine convolute, one and a half times to twice the total length. On old individuals the nape and back of the head become strongly arched, the latter becoming quite prominent, and the scales are lost from the interorbital space and forward. The thickness and the worn appearance of the scales suggests a great deal of rubbing against the rocks or gravel. On specimens of three inches the convex and glossy scales are hardly to be detected; and those of two inches are much like the Funduli, the head and shoulders being less prominent and the body more compressed. As in the other species the main osseous support of the caudal is a single very broad fan-like ray, in which there is little or no evidence of fusion, passing directly backward from the vertebræ.

Eight inch specimens are olivaceous on the back, lighter to whitish on the lower half of the body. The scales being lighter colored in their centres give the back a tessellated or reticulated appearance. The fins are brownish, more or less clouded. Young less than half grown are much lighter colored; they have a narrow streak of darker along the middle of the flank, faint transverse bands or series of spots or blotches on back and fins, and a yellowish tint below the gills. In this stage snout and eye have about the same length. When about two inches in length the color is much lighter, there are transverse streaks of brown on the fins, clouded blotches, formed of puncticulations, on the flanks and in a somewhat irregular series along the middle, and the cheeks and a streak below the dark line on the middle of the side are silvery. The amount of silvery space on the lower half of the body varies greatly.

Abundant in Lake Titicaca.

Orestias affinis is apparently a variety of *O. Agassizii*, from which it differs in being smaller, shorter, stouter, and lighter olive in color. There are four series of scales below the eye, and the young are spotted, freckled, and transversely blotched on the hinder part of the back, or streaked across the fins very much as in Agassizii. The teeth form a band in which the outer series is larger. The vertebral series of scales are rather irregular in front of the dorsal. There are 15 or 16 + 18 vertebræ. A number of specimens of three and a quarter inches or less were taken in Lake Umayo.

Orestias Owenii.

Orestias Owenii Val., 1846, C. V. Poiss., XVIII, 241; Blkr., 1860, Cypr., 487; Gthr., 1866, Cat., VI, 330, in part.

D. 13; A. 13; P. 17; C. 31.

Height of body, or length of head, one fourth of the total length. Muzzle large, rounded. Fins as in the other species. A narrow band or a line traverses the length of the body. On larger individuals the black line is pale upon a silvery band. Appears to be always small. From lake Urcos, south of Cuzco, 13,000 feet above the sea. The proper position for this form, so far as may be determined from the description, seems to be that of a variety under the species *O. Agassizii.*

Orestias olivaceus sp. n.

B. 5; D. 15; A. 16–17; P. 20–22; Ll. 32; Ltr. 14; Vert. 13 + 18.

Body short, compressed, slightly arched from occiput to caudal, in depth nearly one third of the length without the caudal fin. Head broader than high, swollen at the cheeks, one third as long as the body to the caudal base; crown convex between and in front of the eyes, rather concave at the occiput. Snout short, as long as the eye, comparatively narrow, blunt, rounded. Mouth small, vertical, cleft reaching downward little below the level of the middle of the eye. Teeth slender, subconical, hooked, in a single series. Eye medium, one fifth of the head, as long as the snout, half as wide as the interorbital space. Scales large, with small granulations and striæ that are quite harsh to the touch, some near the head thicker and convex, three vertebral series larger and regular; cheek scales in three series, below the hinder half of the eye; a naked space around the eye, enclosed by a series of pores. Fins medium, broad; dorsal midway from occiput to tail, its base longer than the distance between it and the caudal;

anal little nearer the latter; pectorals broad, rounded, reaching more than half way to the anal; caudal pedicel deep, the fin deeper than long, subtruncate.

Color of specimens of four and a half inches, olive, darker on back, silvery on belly and throat; fins paler, uniform, or with a darker streak around the base of the caudal. Three inch specimens are olive, with faint mottlings of darker, on head, body, and fins, silvery on flanks and lower surfaces, and dark on the chin. Individuals of two inches are olivaceous mottled with brownish, with silvery cheeks and a silvery band along the lateral line; belly whitish.

Compared with *O. luteus*, in specimens of equal length, this species is much less rough and angular, and has a different coloration, a smaller mouth and less arch to the back. Lake Umayo, whence the specimens were brought, is said to be without an outlet, nine miles northwest of Lake Titicaca, and four hundred feet higher.

Orestias albus.

Orestias albus Val., 1839, L'Inst., VII, 118, — 1846, C. V. Poiss., XVIII, 242, pl. 537; Blkr., 1860, Cypr., 487; Garm., 1876, Bull. M. C. Z., III, 276.
Orestias Mülleri (part) Gthr., 1866, Cat., VI, 330.

B. 5; D. 14–15; A. 14–16; P. 21; Ll. 31; Ltr. 12; Vert. 13 + 18.

Body short, stout, compressed, rising high above bases of pectorals, greatest depth about equal to length of head. Head large, about two fifths of the length of the body without the caudal, lateral angles blunt, crown flat to concave. Snout large, longer than eye, wide and deep, greatest width about half that of head, chin prominent. Mouth large, vertical, cleft descending little below the level of the lower edge of the eye. Teeth not as numerous or strong as those of *O. Cuvieri*. Eye medium, two elevenths of the head, equal to distance from the mouth, two thirds of snout, more than half of the interorbital space. Scales large, rough with granulations, largest on head and above pectorals, fourteen to fifteen wide ones between head and dorsal, three rows below the eye, lacking behind the preorbital and at each side of the vertebral series. Base of dorsal its length from the caudal, origin half way from the latter to the head. Margins of pectorals, dorsal and anal rounded. Caudal subtruncate with angles rounded, half as long as head.

Brown to olive, dark to light yellowish or whitish, centres of scales lighter; white to yellowish below. Specimens described five and a half

inches in length. Young, half grown or less, appear darker on body and fins, and clouded blotches of dark are sometimes arranged in three or four series along the flank.

The large snout serves to distinguish this species from *O. luteus;* its breadth at the mouth makes the head less pointed and gives it more of the appearance of being truncate. On old individuals the forehead is concave and the snout turned upward so as to resemble that of *O. Cuvieri.*

Abundant in Lake Titicaca.

Orestias luteus.

Orestias luteus Val., 1839, L'Inst., VII, 118, — 1846, C. V. Poiss., XVIII, 243; Blkr., 1860, Cypr., 487.

Orestias Mülleri Gthr., 1866, Cat., VI, 330, in part.

B. 5; D. 15; A. 15–16; P. 19–20; Ll. 31–32; Ltr. 14; Vert. 13 + 18.

Body compressed, short, high in front of the dorsal. Head broad posteriorly, flattened or concave on the crown, pointed at the snout, one third as long as the body to the caudal, equal depth. Snout short, as long as eye, pointed. Mouth small, cleft hardly reaching as low a level as the lower edge of the eye. Eye as long as snout, half as wide as interorbital space, two-ninths of head. First dorsal ray half way from occiput to base of caudal, above third anal ray. Caudal short, broader than long, convex on hinder margin. Scales large, rough, granulated, thickened on head and shoulders, thirteen in the series between head and dorsal, three series on cheek, three vertebral series wider. On large specimens the head is as wide as long and the angles at the sides are very distinct.

Olivaceous to yellowish, with fine puncticulations of black, edges of scales darker, lighter below the lateral line. Some are much clouded or mottled with darker; in cases this color extends down the cheeks to the throat. Small ones have clouded spots of darker, traces of bands across the fins, and a faint band of silvery, in which there is a narrow streak of dark, along the flank. The scales of the young are not granulated, but are thin and bear fine striations. A female in the collection, with mature eggs, is six inches in length. The stomach contains small mollusca.

Lake Titicaca.

Orestias Jussieui.

Orestias Jussiei Val., 1846, C. V. Poiss., XVIII, 235, pl. 535; Gthr., 1866, Cat., VI, 329; Eig., 1891, P. U. S. Mus., XIV, 65.

Orestias Jussieui Cast., 1855, Exp. Am. Sud, Poiss., pl. 27, fig. 3; Blkr., 1860, Cypr., 487.

D. 14; A. 13; P. 14; C. 28.

In being short and considerably arched in front of the dorsal, as figured by Cuvier and Valenciennes, this species resembles *O. albus* and *O. luteus*, from which it is easily distinguished by its smooth scales. Between it and *O. Agassizii* the differences in arch of back and shapes of crown and snout are very marked. Length of head less than depth of body, little less than one third of body without caudal. Crown flattened. Snout massive, twice as long as eye. Mouth large, cleft descending much below the level of the eye, oblique. Eye half as long as snout, one-sixth the length of head. Scales on back forward from the dorsal, and on head and cheeks large, thick, smooth. Suborbital, cheek, and opercle covered with scales. Largest scales above the pectorals. Behind those that are enlarged the scales are thin and bear concentric striæ. Ventral surface naked anteriorly. Color yellowish green, fins pale. Described from four inch specimens.

Valenciennes says his examples came from Titicaca, Guasacona River, and the Lake Chinchoro, near Cuzco. The dimensions given suggest that he had two species in hand, for part of his details, in regard to crown and length of head, apply to *O. Agassizii* and not to the form he figures as *O. Jussieui*.

Orestias Incæ sp. n.

Plate III. Fig. 9, teeth.

B. 5; D. 16–18; A. 16–18; P. 18–20; Ll. 32; Ltr. 16–17; Vert. 13 + 18.

Body much compressed, depth two fifths of length, without caudal, or one third of total, highest point at first rays of dorsal, nearly straight from snout to dorsal fin. Head narrow, higher than deep, little less than one third of total length; crown a trifle convex transversely, straight, back becoming slightly arched behind occiput. Snout medium, as long as eye, blunt, broad. Mouth small, vertical, cleft downward almost to lower level of eye. Eye large, as long as snout, two sevenths of head, not quite as wide as interorbital space. Teeth few, simple, hooked, apparently in a single series. Pharyngeal teeth stout, with a shoulder. Scales medium, not granulate,

but somewhat rough with concentric striæ, flat, thin, not thickened on anterior parts of body or on head; belly entirely covered. Cheek scales, below the eye, in three rows, two of which extend forward farther than the orbit. Origin of dorsal midway from head to caudal, nearly opposite that of anal. Caudal broad, subtruncate, two thirds as long as head. Intestine about equal to the total length.

Brown to yellowish brown, clouded or mottled with darker; sometimes with three rather indefinite and irregular longitudinal series of blotches on the sides. Males and females are adult at a length of two and a half inches.

The species is most closely allied to *O. albus* and *O. luteus*, with which it is found in Lake Titicaca; from the former it differs in length of snout and shapes of head and body, from the latter especially in shape of head, and from both in the squamation of the ventral surface. On one specimen of eight the rays of which were counted, dorsal and anal have each but fourteen rays, indicating a considerable amount of individual variation.

HAPLOCHILICHTHYS.

Aplocheilichthys Blkr., 1862, Poiss. Guin., 116, — 1863, Atl., III, Cypr., 140.
Epiplatys Gill, 1863, P. Phil. Ac. (1862) 136, part.
Lycocyprinus Pet., 1868, Mb. Brl. Ak., 396.

Corpus elongatum compressum, squamis magnis deciduis vestitum, dorso humili, ventre convexo. Caput et rostrum latum depressa. Maxilla superior protractilis. Rictus terminalis. Dentes intermaxillares et inframaxillares uniseriati, simplices; vomerini nulli. Os supramaxillare post os intermaxillare rejectum. Pinna dorsalis pauciradiata analis parti posteriori opposita in initio dimidii corporis posterioris inserta. Pinnæ ventrales longe post basin pectoralium insertæ Pinna analis media corporis longitudine inserta, pluriradiata, altior quam longa. Apertura branchialis ampla. Membrana branchiostega radiis 5. (Bleeker.)

This is Lycocyprinus of Peters, which that author says, in comparing with his Nothobranchius, "ebenfalls freie Nebenkiemen, aber gebogene Zwischenkiefer und eine kurze, ganz hinten über dem Ende der mittellangen Analflosse stehende Rückenflosse hat. Er hat ebenfalls die Kiemendeckelstücke deutlich beschuppt und die Zähne der hinteren, so wie der vorderen Reihe etwas grösser."

Haplochilichthys and Nothobranchius differ from other Cyprinodontidæ in possessing pseudobranchs, and in the enlargement of the teeth in the inner row on the jaws; they are distinguished from one another by the structure of the jaws.

No doubt several of the species of Haplochilus from Africa are yet to be placed in this genus. The characters necessary for a positive decision are not given in the descriptions, and in the absence of specimens they remain as placed by others.

Haplochilichthys spilauchen.

Pœcilia spilauchena Dum., 1861, Arch. Mus., X, 258, pl. 22, fig. 6.
Aplocheilichthys spilauchen Blk., 1862, Mem. Poiss. Guin., 117.
Aplocheilichthys typus Blk., 1862, Mem. Poiss. Guin., 116, pl. 24, fig. 1, — 1863, Atl., III, 140.
Epiplatys spilauchen Gill, 1863, P. Phil. Ac. (1862), 136.
Haplochilus spilauchen Gth., 1866, Cat., VI, 312; Steind., 1870, Sb. Ak. Wien, LXI, ext. p. 26, — 1893, Notes Leyd. Mus., XVI, 75; Sauv., 1880, Nouv. Arch. Mus., III (2), 23, 31.
Pœcilia Bensoni Pet., 1864, Mb. Brl. Ak., 395.
Pœcilia sexfasciata Pet., 1864, Mb. Brl. Ak., 396.
Haplochilus sexfasciatus Gth., 1866, Cat., VI, 313; Sauv., 1880, Nouv. Arch., III (2), 23.
Lycocyprinus sexfasciatus Pet., 1868, Mb. Brl. Ak., 146.

D. 7–8; A. 12–13; V. 6; Ll. 24–27; Ltr. 8.

Depth of average specimens about two sevenths of the length to the base of the caudal; head two sevenths to three tenths. Eye three sevenths to three eighths, forehead one half, and length of snout four elevenths to one third of the length of the head. Dorsal origin near half way from the head to the base of the caudal. Anal with several rays to half of its base in advance of the origin of the dorsal.

Hinder half of the body with six or seven grayish violet narrow transverse bands, and as many on the caudal. Males with a little broader silvery band in front of each of those on the body, and the anal flecked with light and darker on its hindmost rays. On young the transverse bands are indistinct or absent. (Steindachner.)

Jaws equal in length. Dorsal origin midway from eye to end of caudal, opposite the seventeenth scale of the lateral line and the middle of the anal. All the fins elongate in the male. Nearly uniform greenish olive, with a blackish spot behind the upper part of the humerus. Males have the tail ornamented with irregular silvery cross bars, and the vertical fins with fine blackish transverse lines. (Günther.) Liberia; Gaboon.

NOTHOBRANCHIUS.

Nothobranchius Peters, 1868, Mb. Brl. Ak., 145, — Flussfische Mossambique, 60.

Rictus mediocris, adscendens. Ossa intermaxillaria haud angulatim recurvata; dentalia mandibularia immobilia, præorbitale angustum, infraorbitalia nulla. Dentes intermaxillares et mandibulares acuti, pluriseriati, seriei externæ et internæ majores recurvati; pharyngei breves conici (postremi majores). Radii branchiostegi utrinque seni, branchiæ quaternæ; pseudobranchiæ liberæ; processus arcus branchialis primi anteriores longi. Caput squamosum, squamæ mediocres, linea lateralis parum distincta. Pinna dorsalis mediocris, pone ventrales anali opposita. Ventriculus parvus, intestinum breve. Vesica aërea simplex. Feminæ masculis haud dissimiles.

Diese Gattung, welche mit den übrigen kurzdarmigen carnivoren Cyprinodonten in den meisten Punkten, in der Entwickelung der hinteren Fortsätze der Zwischenkiefer, in den durch Naht befestigten und für sich allein nicht beweglichen zahntragenden Knochen des Unterkiefers, in dem allen Cyprinodonten zukommenden Mangel des Infraorbitalbogens und der blindsacklosen Bildung des Magens übereinstimmt, während sie sich in der Zahnbildung den *Fundulus* (und *Hydrargyra*) anschliesst, unterscheidet sich wesentlich durch die Gestaltung der Zwischenkiefer, welche, wie bei Cyprinen und den meisten Knochenfischen, in gewöhnlicher Weise zum Mundwinkel herabsteigen, ohne einen nach hinten vorspringenden Winkel zu bilden, so wie durch die Anwesenheit von freien Pseudobranchien. Letztere sind zwar nicht sehr gross indem sie nur drei bis vier kiemenförmige Fortsätze bilden, aber deutlich, während ich sie ausserdem nur noch bei einer erst neuerdings von mir aufgestellten Gattung von Cyprinodonten aus Westafrica, *Lycocyprinus*, gefunden habe. (Peters.)

Nothobranchius orthonotus.

Cyprinodon orthonotus Pet., 1844, Ber. k. Akad. Wiss. Brl., 35; Blk., 1860, Cypr., 484.
Hydrargyra maculata Pet., 1855, Arch. f. Naturg., I, 269.
Hydrargyra orthonota Pet., 1868, Flussf. Mossamb., pl. 12, fig. 1.
Nothobranchius orthonotus Pet., l. c., 61.
Fundulus orthonotus Blk., 1875, Poiss. Madagasc., 101.

D. 15; A. 15; V. 6; P. 16; C. 19.

Körperform gestreckt. Linie des Rückens von der Schnautze bis zum Schwanz gerade, Bauchlinie convex. Eine kurze Rückenflosse gerade über

der Afterflosse, ein wenig grösser als diese. Zwischenkiefer und Unterkiefer mit einer Binde feiner spitzer gekrümmter Zähne, deren äussere Reihe die hinteren überragt. Gaumen zahnlos. Schlundknochen mit kurzen dicken conischen Zähnen besetzt. Keine Nebenkiemen. Fünf Kiemenstrahlen. Seitenlinie schwach, gerade. Schuppen glatt, an hinteren Rand ganz. Grundfarbe dunkelgrün, metallisch glänzend, nach den Unterbauch in's Goldige übergehend. Auf dem hintern Dritttheil der Schuppen ein schwarzbrauner Fleck, wodurch am ganzen Körper alternirende Reihen von solchen Querflecken entstehen. Die hinteren Flossen goldgelb mit eben solchen Flecken. Ein einfacher Magen und grader kurzer Darm ohne Anhängsel. Einfache Schwimmblase. Die Eierstöcke führen nach aussen. Mozambique. (Peters.)

NOTES.

The foregoing descriptions were drawn mainly from specimens in the collections at hand. When dependence was placed on literature the words of the original characterization have been put forward, rather than translations.

The scales of the lateral line were counted from the upper angle of the gill opening to the end of the series on the tail. The transverse series were usually taken from the origin of the dorsal fin to the anal. On many of the species the number of scales in the lateral line closely corresponds with the number of vertebræ.

All of the rays in the fins were enumerated. No special stress was placed on the shapes of the fins, as they change so much with age or in breeding males and females.

The gill rakers being normal in the younger stages and degrading and to some extent disappearing later, as in certain Salmonidæ, Pleuronectidæ, etc., little dependence was placed on them.

The majority of the teeth were hardly visible without the aid of lenses; consequently the figures represent them greatly enlarged. Size varying with the individual, the shapes were of most value in comparisons; yet in each figure (group), the details all having the same enlargement, comparative sizes of outer, inner, and pharyngeal teeth were preserved.

Belonesocinæ, being the earlier name, takes the place of *Gambusiinæ* on pages 19 and 80.

Orestiasinæ is to be inserted above *Orestias* on page 145.

Nothobranchiinæ is to precede *Haplochilichthys* on page 156.

Opportunity is here taken to express a hearty appreciation of the kindness of Prof. Dr. Karl Möbius, Dir. Zool. Mus. Berlin, and of his assistant Dr. Hilgendorf, in regard to examination of particular types, of that of Dr. B. W. Evermann, of the U. S. Fish. Comm., for certain publications, and of that of Prof. H. Garman, of the Ky. State College, for specimens.

LITERATURE.

Agassiz, L., 1834, Description de quelques espèces de cyprins du Lac de Neuchatel, qui sont encore inconnues aux naturalistes: Mém. Soc. Sci. Nat. Neuchatel, I, 35.

1839, Recherches sur les Poissons Fossiles, V, pt. 2, p. 47.

1844, Poiss. Fossiles, I, pp. xlviii, 170.

1853, Recent Researches of: Am. Jour. Sci. and Arts, XVI, 134.

1854, Notice of a Collection of Fishes from the Southern Bend of the Tennessee River, Alabama: Am. Jour. Sci., XVII, pp. 297, 353, and separate.

1855, Remarks on Viviparous Cyprinodonts: Am. Jour. Sci., XIX, 136.

1868, A Journey in Brazil.

Agassiz, A., 1882, On the Young Stages of some osseous Fishes, pt. 3: Proc. Am. Acad., XVII, 271.

Albertus Magnus, 1479, Opus de Animalibus.

Aldrovandi, 1613, De Piscibus Libri V, et de Cetis Lib. unus.

Artedi, 1738, Genera Piscium. Synonymia Piscium.

1761, Anableps: Seba's Thesaurus, III, 108*a* – 109.

Ayres, 1843, Enumeration of the Fishes of Brookhaven, Long Island: Bost. Jour. Nat. Hist., IV, 265.

Baird, 1855, Report on the Fishes of the New Jersey Coast: Ninth Ann. Rep. Smithson. Inst., for 1854.

1873, List of Fishes collected at Wood's Hole: U. S. Fish. Comm. Rep., I, 823.

Baird & Girard, 1854, Descriptions of New Species of Fishes collected by the U. S. and Mex. Bound. Survey: Pr. Phil. Ac., VI, for 1853, 387.

Bean, 1881, Check-list of duplicate North American Fishes, etc.: Pr. U. S. Mus., III, 75.

1882, Account of a Shipment with a note on some Collections: B. U. S. F. Comm., I, 205.

1884, Notes on Fishes observed at the Head of Chesapeake Bay, etc.: P. U. S. Mus., VI, 365.

1888, Description of five new Fishes, from Guanajuato, Mex.: P. U. S. Mus., X, 370.

1889, Report on the Fishes observed in Great Egg Harbor Bay, New Jersey, etc.: B. U. S. F. Comm., VII, 129.

1892, Notes on Fishes collected in Mexico, with descriptions of New Species: Pr. U. S. Mus., XV, 283. Fishes from Chesapeake Bay: P. U. S. Mus., XIV, 85.

Bean, B., 1892, Fishes collected in Chesapeake Bay, etc.: P. U. S. Mus., XIV, 83.

Beavan, 1877, Handbook of the Freshwater Fishes of India.

Bechstein, 1794, Kurzgefasste gemeinnütz. Naturgesch. des In- u. Auslandes, I, pt. 2.

Bellotti, 1858, Rettificazioni alle specie finora note di Ciprinodonti Europei: Mem. R. Accad. Sci. Torino, XVII, p. clix.

Bleeker, 1850, Bijdrage tot de kennis der ichthyologische fauna van Midden- en Oost-Java, etc.: Verh. Bat. Gen., XXII.

Bleeker, 1852, Bijdrage tot de kennis der Snoekachtige visschen van den Soenda-molukschen archipel: Verh. Bat. Gen., XXIV.

1853, Nalezingen op de ichthyologische fauna van Bengalen en Hindostan: V. B. G., XXV.

1854, Nieuwe nalezingen op de ichthyologie van Japan: V. B. G., XXVI. Ichthyologische waarnemingen gedaan op verschillende reizen in de residentie Bantam: Nat. Tydschr. Ned. Ind., VII, 309.

1855, Verslag van eenige vischverzamelingen van Oost-Java: N. S. N. I., IX, 391.

1857, Zesde bijdrage tot de kennis der vischfauna van Sumatra: A. S. S. I. N., III.

1859, Enumeratio specierum piscium hucusque in Arch. ind. observatarum, etc.: A. S. S. I. N., VI.

1860, Familia Cyprinodontoidei, in Ichth. Arch. ind. prodr., II, Cypr., 479: A. S. S., I. N., VII. Achtste bijdrage tot de kennis der vischfauna van Sumatra: A. S. S. I. N., VIII. Dertiende bijdrage tot de kennis der vischfauna van Borneo: l. c. Zesde bijdrage tot de kennis der vischfauna van Japan: l. c.

1862, Mémoire sur les poissons de la côte de Guinée: Verh. H. M. W.

1863, Famille des Cyprinodontoïdes: Atl. Ichthyol., III, 139.

1879, Énumération des Espèces de Poissons actuellement connues du Japon et Description de trois espèces inédites: Verh. K. A. W., XX.

Bleeker & Pollen, 1875, Recherches sur la Faune de Madagascar et de ses Dépendances, 4me partie, Poissons et Pêches.

Bloch, 1785–95, Naturgeschichte der ausländischen Fische.

Bloch & Schneider, 1801, Systema Ichthyologiæ iconibus cx illustratum.

Blumenbach, 1780, Handbuch der Naturgeschichte.

Blyth, 1858, Fishes from Pegu, Calcutta and elsewhere: J. As. Soc., Bengal, 281.

1860, On some Fishes from Port Blair: l. c., 111.

Bollman, 1887, Notes on a Collection of Fishes from the Escambia River, etc.: P. U. S. Mus., IX, 462.

1890, A Report on the Fishes of Kalamazoo, Calhoun, and Antrim Counties, Michigan: B. U. S. F. Comm., VIII, 219.

Bonaparte, 1831, Sagio di una Distribuzione metodica degli Animali vertebrati.

1838, Synopsis Vertebratorum Systematis: Nuovi Annali delle Scienzi Naturali, Bologna, II, 105. Sistema ichthyologicum. Conspectus familiarum et subfamiliarum; with Selach. Tab. anal.

1840, Prodromus Systematis Ichthyologiæ: Nouv. Ann. Sci. Nat., Bologna, IV, 181. Systema Vertebratorum.

1841, A new Systematic Arrangement of vertebrated Animals: Tr. Linn. Soc., XVIII, p. 247.

1842, Iconographia della Fauna Italica, III, Pesci.

1845, Specchio generale dei sistemi Erpetologico, Anfibiologico ed Ittiologico.

1846, Catalogo Metodico dei Pesci Europei.

1850, Conspectus Systematis Ichthyologiæ, ed. reformata.

Bonnaterre, 1788, Tableau Encyclopédique, Ichthyologie.

Borowski, 1784, Natürliche Abbildungen der merkwürdigsten Fische nach ihren Geschlechtern.

Boulenger, 1887, An Account of Fishes obtained at Muscat, East Coast of Arabia: P. Z. S. Lond., 653.

1889, On a new Snake and two new Fishes from Brazil: Ann. Mag. N. H., 265.

1890, Descriptions of two new Cyprinodontoid Fishes: Ann. Mag. N. H., VI (6), 169.

Buchanan-Hamilton, 1822, An Account of the Fishes found in the Ganges and its Branches.

Canestrini, 1866, Prospetto Critico dei Pesci d' Acqua dolce d' Italia: Arch. per la Zool. l'Anat. e la Fisiol., IV.

1872, Pesci delle Acque dolci; Fauna d' Italia, pt. III.

Cantor, 1849, Catalogue of Malayan Fishes: Jour. As. Soc., 983.

Chappe d'Auteroche, 1772, Voyage en Californie etc.; Trans., 1778, p. 89.

Charleton, 1677, Exercitationes de differentiis et nominibus animalium.

Cope, 1865, Partial Catalogue of the Cold-blooded Vertebrata of Michigan: P. Phil. Ac., 78.

1869, On the Distribution of Freshwater Fishes in the Allegheny Region of Southwestern Virginia: J. Phil. Ac., VI, 207.

1871, Partial Synopsis of the Freshwater Fishes of North Carolina: P. Am. Phil. Soc., XI, 448.

1874, On the Plagopterinæ and the Ichthyology of Utah: P. Am. Phil. Soc., 1874–76, 129.

1874, Description of some Species of Reptiles, etc.: P. Phil. Ac., 66.

1875, Note on the Ichthyology of Lake Titicaca: J. Phil. Ac., 185.

1878, Synopsis of the Fishes of the Peruvian Amazon: P. Am. Phil. Soc., XVII, 673.

1880, On the Zoological Position of Texas: Bull. 20 U. S. Mus.

1894, On Fishes obtained in Rio Grande do Sul: P. Am. Phil. Soc., XXXIII, 84.

Cope & Yarrow, 1875, Report on the Fishes collected by Wheeler's Expedition, Vol. V, 635.

Costa, 1854, Pesci della Fauna Napolitana, 1840–54.

Cragin, 1885, Preliminary List of Kansas Fishes: Bull. Washb. Lab., I, 105.

Cronise, 1868, The Natural Wealth of California, p. 495.

Cuvier & Valenciennes, 1846, Histoire Naturelle des Poissons, XVIII.

Day, 1865, The Fishes of Malabar.

1867, On some new or imperfectly known Fishes of India: P. Z. S. Lond., 699.

1872, Notes on Fish, collected by Dr. Stoliczka in Kachi: J. As. Soc. Beng., 258.

1873, Report on the Freshwater Fish and Fisheries of India and Burmah.

1878, The Fishes of India.

DeKay, 1840, Catalogue of the Animals belonging to the State of New York, etc.: Geol. Surv. of N. Y., Assembly Doc., No. 50, p. 7.

1842, New York Fauna, Fishes.

Doderlein, 1879, Prospetto metodico delle varie Specie di Pesci riscontrate sin' ora nelle acque marine e fluviale della Sicilia, etc.: Atti Ac. Sci. Lett. ed Arti di Palermo, (2) VI, 26.

Donndorff, 1798, Zoologische Beyträge, III.

Duméril, 1856, Ichthyologie Analytique ou Classification des Poissons: Mém. Ac. Sci., XXVII.

1861, Reptiles et Poissons de l'Afrique occidentale: Arch. Mus., X, 137.

Duméril, Duvernoy, Froriep & Meckel, 1809–10, Vorlesungen über vergleichende Anatomie von G. Cuvier.

Duvernoy, 1844, Ueber die Entwickelung von *Pœcilia surinamensis* Val.: Froriep's Notiz., XXXII.

1844, Observations pour servir à la connaissance du développement de la Pœcilie de Surinam (*Pœcilia surinamensis* Val.): Ann. Sc. Nat., I (3), 313; Compt. rendus Acad. Sc., XVIII, 667,720; L'Institut, XII, No. 540, p. 153.

Edwards, 1861, A Voyage up the Amazon.

Eigenmann, 1888, Fishing on the Colorado Desert: West Amer. Scientist, V, 2.
1889, Description of a new Species of Cyprinodon: P. Cal. Ac. Sci., I (2), 270.
1892, A Catalogue of the Freshwater Fishes of South America: P. U. S. Mus., XIV. A Catalogue of the Fishes of the Pacific Coast of America North of Cerros Island: Ann. N. Y. Acad. Sci., VI. The Fishes of San Diego: P. U. S. Mus., XV, 123.
1893, Catalogue of the Freshwater Fishes of Central America and Southern Mexico: P. U. S. Mus., XVI, 53.
1894, Notes on some South American Fishes: Ann. N. Y. Acad., VII, 625. *Cymatogaster aggregatus* Gibbons, etc.: B. U. S. F. Com. (for 1892), 401. Report of the Indiana State Biological Survey, Zoology.

Evermann, 1892, A Report upon Investigations made in Texas in 1891: B. U. S. Fish Comm. for 1891, 61. Notes on Texan Fishes, with Descriptions of new Species: l. c., 75.

Everm. & Fordice, 1885, List of Fishes collected in Harvey and Cowley Counties, Kansas: P. Phil. Ac., 412.

Everm. & Jenkins, 1889, Notes on Indiana Fishes: P. U. S. Mus., XI, 43.

Everm. & Kendall, 1894, The Fishes of Texas and the Rio Grande Basin, considered chiefly with reference to their Geographic Distribution: B. U. S. F. Comm., for 1892, 57.

Figulus, 1540, Ichthyologia, seu Dialogus de Piscibus.

Filippi, 1861, Lebistes nuovo genere di pesce della famiglia dei Ciprinodonti: Arch. per la Zool., l'Anat. e Fisiol., I, 69.

Fitzinger, 1832, Ueber die Ausarbeitung einer Fauna des Erzherzogthums Oesterreich, nebst einer systematischen Aufzählung der in diesen Lande vorkommenden Säugethiere, Reptilien und Fische.

Fleming, 1822, The Philosophy of Zoology on a general View of the Structure, Functions, and Classification of Animals, II, 386.

Forbes, 1878, The Food of Illinois Fishes: Bull. 2 Ill. Lab., 71.
1883, The Food of the smaller Freshwater Fishes: B. 6 Ill. Lab., 65.
1890, On the Food Relations of Freshwater Fishes: B. Ill. Lab., II, 475.

Garman, H., 1890, A preliminary Report on the Animals of the Mississippi Bottoms near Quincy, Illinois: Bull. Ill. Lab., III, 123.
1894, A preliminary List of the Vertebrate Animals of Kentucky: B. Essex Inst., xxvi.

Garman, S., 1876, Fishes and Reptiles of Lake Titicaca: Bull. 11 M. C. Z., III, 273.
1881, New and little known Reptiles and Fishes in the Museum Collections: Bull. M. C. Z., VIII, 85.

Gervais, 1853, Remarques sur les Poissons Fluviatiles de l'Algérie, et descriptions de deux genres nouveaux sous les noms de Coptodon et Tellia: Ann. Sc. Nat., XIX, 15.
1866, Nouvelles remarques sur les Poissons fluviatiles de l'Algérie: Compt. rend. Ac. Sci., LXIII.

Gesner, 1556, De Piscibus et Aquatilibus omnibus libelli III. novi.
1558, Historiæ Animalium Liber IV. qui est de Piscium et Aquatilium animantium natura. Also ed. 1620, IV.

Gilbert, 1889, Fourth Series of Notes on the Fishes of Kansas: B. 9 Washb. Lab., 38.
1890, Notes on Fishes from the lowlands of Georgia, etc.: B. U. S. F. Comm., VIII, 225.
1891, Report of Explorations made in Alabama, etc.: l. c., IX, 144.
1893, Report on the Fishes of the Death Valley Expedition, etc.: N. Amer. Fauna, No. 7, 229.

Gill, 1856, Smithsonian Report, 264.

Gill, 1861, Description of a new Species of the genus Anableps: P. Phil. Ac., 3. Catalogue of the Fishes of the Eastern Coast of N. Amer. from Greenland to Georgia: P. Phil. Ac.

1863, On the West African genus Hemichromis and descriptions of new species in the Museums of the Academy and Smithsonian Institution: P. Phil. Ac. (1862), 134.

1865, Synopsis of the Fishes in the Gulf of St. Lawrence and Bay of Fundy: Canad. Naturalist, Aug.

1872, Arrangement of the Families of Fishes: Smithson. Miscell. Contr.

1873, Cat. Fish. E. C. N. Amer.: R. U. S. F. Comm., I.

1876, Notes on Fishes from the Isthmus of Panama, etc.: P. Phil. Ac., 335.

1877, Synopsis of the Fishes of Lake Nicaragua: P. Phil. Ac., 175.

1894, Families and subfamilies of Fishes: Mem. Nat. Acad., VI, 127. The Nomenclature of the Family Pœciliidæ or Cyprinodontidæ: P. U. S. Mus., XVII, 115.

Girard, 1854, Observations upon a Collection of Fishes made on the Pacific Coast of the United States, etc.: P. Phil. Ac., VII, 142.

1859, Ichthyological Notices: P. Phil. Ac., 56, 113, 157. Report on the Fishes: Pacific R. R. Reports, X. Ichthyology of the U. S. and Mex. Bound. Surv., II.

Gmelin, 1789, Caroli a Linné Systema Naturæ, I.

Goldfuss, 1820, Handbuch der Zoologie, II, 16.

Goode, 1876, Catalogue of the Fishes of Bermuda: B. 5 U. S. Mus.

1877, A preliminary Catalogue of the Reptiles, Fishes, etc., of the Bermudas: Am. Jour. Sci., XIV.

1880, A preliminary Catalogue of the Fishes of the St. John's River and the East Coast of Florida, etc.: P. U. S. Mus., II, 108.

Goode & Bean, 1879, A List of the Fishes of Essex County, including those of Mass. Bay, etc.: B. Essex Inst., XI.

1880, Catalogue of a Collection of Fishes obtained in the Gulf of Mexico, etc.: P. U. S. Mus., II, 333. Catalogue of a Collection of Fishes sent from Pensacola, Florida, etc.: P. U. S. Mus., II, 121.

1883, A List of the Fishes recorded as occurring in the Gulf of Mexico: P. U. S. Mus., V, 234. Descriptions of twenty-five new Species of Fish from the Southern United States, etc.: P. U. S. Mus., V, 412.

1886, On the American Fishes in the Linnæan Collection: P. U. S. Mus., VIII, 193.

Gosse, 1851, Natural History of Fishes, 205. A Naturalist's Sojourn in Jamaica, 84.

Gray, 1854, Gronow's Catalogue of Fish, 192.

Gronow, 1754, Museum Ichthyologicum.

1763, Zoophylacium Gronovianum, I.

Günther, 1859, On the Reptiles and Fishes collected by the Rev. H. B. Tristram in Northern Africa: P. Z. S. Lond., 469.

1866, Catalogue of the Fishes in the British Museum, VI, 299.

1868, An Account of the Fishes of Central America, etc.: Tr. Z. S. Lond., VI (5), 377.

1874, Descriptions of new Species of Fishes in the British Museum: Ann. Mag. N. H., XIV (4), 368.

1880, An Introduction to the Study of Fishes. Report on the Shore Fishes, of the Challenger Expedition: Zool., I, part 6.

1883, On a new Species of Cynolebias from the Argentine Republic: Ann. Mag. N. H., XI (5), 140.

1889, Report on the Pelagic Fishes collected by the Challenger: Tr. Zool. Soc. Lond.

Günther, 1894, Second Report on the Reptiles, Batrachians and Fishes, from British Central Africa: P. Z. S. Lond. (1893), 616.

Guichenot, 1855, Historia Física, Política y Natural de la Isla de Cuba, por Sagra, Peces.

1859, Note sur deux espèces nouvelles de Poissons du genre Cyprinodon: Rev. & Mag. Zool., 377.

1866, Catalogue des Poissons de Madagascar etc.: Mém. Soc. Imp. Sc. Nat. Cherb., XII.

Gulia, 1861, Tentamen Ichthyologiæ Melitensis.

Hay, 1881, On a Collection of Fishes from Eastern Mississippi: P. U. S. Mus., III, 488.

1883, A Collection of Fishes from the Lower Mississippi Valley: B. U. S. F. Comm., II, 57.

1886, Notes on a Collection of Fishes from Florida, etc.: P. U. S. Mus., VIII, 552.

1888, A Contribution to the knowledge of the Fishes of Kansas: P. U. S. Mus., X, 242.

Heckel, 1844, Ichthyologie: Russegger's Reisen in Europe, Asien und Africa, etc., I.

1849, Ichthyologie: l. c., II.

1852, Eine neue Gattung von Pœcilien mit rochenartigem Anklammerungsorgane: Sb. Akad. Wien, CI, 289.

Hensel, 1868, Beiträge zur Kenntniss der Wirbelthiere Südbrasiliens: Archiv für Naturgeschichte, XXXIV, p. 323, 1869, XXXV, p. 50.

Henshall, 1888, Contributions to the Ichthyology of Ohio, No. 1: J. Cin. Soc. Nat. Hist., 76.

1891, Report of a Collection of Fishes made in Southern Florida: B. U. S. F. Comm., IX, 371.

Hermann, 1783, Tabula Affinitatum Animalium, etc.

1804, Observationes Zoologicæ, etc., ed. Hammer.

Hilgendorf, 1888, Fische aus dem Victoria-Nyanza (Ukerewe See): Ges. Nat. Fr., 75.

1891, Aufzählung der von Emin Pascha und Dr. Stuhlmann gesammelten Fische und Krebse: Ges. Nat. Fr., 18.

Holmes, 1863, Report on the Fishes of Maine; 2d Ann. Rep. Nat. Hist. and Geol. of Maine, 1862.

Home, 1828, Lectures on Comparative Anatomy, VI, pl. 38, 52, 53.

Houttuyn, 1765, Natuurlyke Historie of Uitvoerige Beschryving der Dieren, Planten en Mineralen, etc., VIII.

Humboldt et Valenciennes, 1828, Recherches sur les Poissons fluviatiles de l'Amérique équinoxiale: Recueil d'Observations de Zoologie et d'Anatomie comparée, etc., II, 1832 (sep. 1828), 145.

Ihering, 1883, Zur Kenntniss der Gattung Girardinus: Zeitschr. Wiss. Zool., XXXVIII, 468.

Janos, 1882, Prodromus Piscium Asiæ Orientalis: Term. Füz, V, Hung. Nat. Mus.

Jenyns, 1842, The Zoology of H. M. S. "Beagle," etc., pt. V, Fish.

Jerdon, 1849, Fishes of Southern India: Madras Journal of Lit. & Sci., XV.

Jordan, 1874, Fishes of Indiana: State Geol. Report.

1876, Manual of Vertebrates, ed. 2, 1878, ed. 5, 1888.

1877, On the Fishes of Northern Indiana: P. Phil. Ac. Review of Rafinesque on American Fishes: Bull. 9, U. S. Mus.

1878, Notes on a Coll. of Fishes from the Rio Grande: B. U. S. G. Sur., IV. Cat. Freshwater Fish N. Amer.: l. c. Cat. Fishes of Ill.: Bull. 2 Ill. Lab.

1880, Notes on Coll. of Fishes from Guanajuato and in Chapala Lake, Mex.: P. U. S. Mus., II.

1881, Notes on Fishes from E. Florida: P. U. S. Mus., III.

JORDAN, 1885, List Fish from Key West, Fla., etc.: P. U. S. Mus., VII. List Fish from Vicinity of New Orleans: l. c. List Fish from Lake Jessup and Indian Riv., Fla.: l. c.

1886, List Fish from Pacific Coast Trop. Amer., etc.: P. U. S. Mus., VIII.

1887, Notes on Fishes of Beaufort, N. C., etc.: P. U. S. Mus., IX. List Fishes of Havana, etc.: l. c. Notes on Specimens described by Cuv. and Val.: l. c. Prelim. List Fishes of West Indies: l. c. Cat. Fish N. Amer., etc.: Ann. Rep. U. S. F. Comm., for 1885.

1889, List Fishes from Mazatlan, etc.: P. U. Mus., XI. Descr. of fourteen species of Freshwater Fishes, etc.: l. c.

1891, Rep. of Expl. in Col. and Utah, etc.: B. U. S. F. Comm., IX.

JOR. & BRAYTON, 1878, Distr. of Fishes in S. C., Ga., and Tenn., etc.: Bull. 12 U. S. Mus.

JOR. & COPELAND, 1877, Check List of Freshwater Fishes of N. Amer.: B. Buf. Soc., III.

JOR. & EIGENMANN, 1888, Notes on Fishes from Charleston, S. C.: P. U. S. Mus., X.

JOR. & GILBERT, 1879, Notes on Fishes of Beaufort Harbor, N. C.: P. U. S. Mus., I.

1881, Notes on Fishes from San Diego, Cal.: P. U. S. Mus., III. List of Fishes of Pacific Coast, U. S., etc.: l. c.

1882, Notes on Fishes of Pacific Coast, U. S.: P. U. S. Mus., IV. Synops. Fish N. Amer.: Bull. 16 U. S. Mus.

1883, Description of a new Cyprinodont (*Zygonectes inurus*): P. U. S. Mus., V. Notes on Fishes about Pensacola, Fla.: l. c. Cat. Fishes from Cape San Lucas, etc.: l. c. List of Fishes from Colima, Mex.: l. c. List of Fishes from Panama: l. c. Notes on Fishes from Charleston, S. C.: l. c.

1887, List Fishes from Ark., Ind. Terr., and Tex.: P. U. S. Mus., IX.

JOR. & JOUY, 1882, Checklist duplicate Fish from Pacific Coast N. Amer.: P. U. S. Mus., IV.

JOR. & MEEK, 1885, List Fishes in St. John's Riv., Fla.: P. U. S. Mus., VII. Descr. of *Zygonectes zonifer*: l. c.

JOR. & SWAIN, 1885, Notes on Fishes from Cedar Keys, Fla.: P. U. S. Mus., VII.

KIRSH, 1892, Notes on the Streams and Fishes of Clinton Co., Ky., etc.: B. U. S. F. Comm., X, 289.

1894, Notes on Fishes from Tributaries of the Cumberland in Ky. and Tenn.: B. U. S. F. Comm., XI, 259.

KLEIN, 1744, Historiæ piscium naturalis, etc., Missus quartus.

KLUNZINGER, 1871, Synopsis der Fische des Rothen Meeres: Verh. Zool. Bot. Ges. Wien, XXI.

KNER, 1860, Ueber Belonesox belizanus, Nov. Gen. et Spec., aus der Familie der Cyprinodonten: Sb. Ak. Wien, XL, 419.

1867, Novara Fische.

KNER & STEINDACHNER, 1865, Neue Gattungen und Arten von Fische aus Central-Amerika: Abh. Ak. Wiss. Wien, I (1864).

KNIGHT, 1866, Descriptive Catalogue of the Fishes of Nova Scotia.

LA CÉPÈDE, 1803, Histoire des Poissons, V.

LENZ, 1782, Anfangsgründe der Thiergeschichte.

LEPORI, 1881, Osservazioni sull' uovo della Lebias calaritana: Atti della R. Acad. dei Lincei, Anno, 278. La *Lebias calaritana*: Ann. Soc. Nat. Modena, (2) Ann. 15, p. 32.

LESUEUR, 1817, Descriptions of four new Species, and two varieties of the Genus Hydrargyra: Jour. Phil. Ac., I, 126.

1821, Descr. of a new Genus, and of several new Species of Freshwater Fish indigenous to the United States: J. Phil. Ac., II.

LINNÉ, 1738, Petri Artedi Sueci, medici Ichthyologia sive Opera omnia de Piscibus.

Linné, 1740, Systema Naturae, ed. 2, — 1744, ed. 4, — 1747, ed. 5, — 1748, ed. 6 & 7, — 1756, ed. 9, — 1758, ed. 10, I, — 1760, ed. 11, I, — 1766, ed. 12, I, — 1767, ed. 13, I.

Linsley, 1844, Catalogue of the Fishes of Connecticut, etc.: Am. Jour. Sci., XLVII, 55.

Linton, 1891, On certain wart-like excrescences occurring on Cyprinodon variegatus: B. U. S. F. Comm., IX, 99.

Martens, 1858, Ueber einige Brackwasserbewohner aus dem Umgebungen Venedigs: Weigm. Arch., XXIV, 152.

1876, Die Preussiche Expedition nach Ost-Asien, Zool., I.

McClelland, 1839, Indian Cyprinidæ: Jour. As. Res., XIX.

McCormick, 1892, Descriptive List of the Fishes of Lorain County, Ohio: Lab. Bull. 2, Oberlin Coll.

Meckel, 1818, Deutsch. Arch. f. Physiologie, IV.

1821–33, System der Vergleichenden Anatomie.

Meek, 1889, Notes on the Fishes of the Cayuga Lake Basin: Ann. N. Y. Ac., IV, 297.

1891, Report of Expl. made in Missouri and Arkansas, etc.: B. U. S. F. Comm., IX, 113.

Milne Edwards, 1862, Leçons sur la Phys. et l'Anat. comp., VII.

Mitchill, 1815, The Fishes of New York, described and arranged: Tr. Lit. and Phil. Soc. N. Y., I, 355.

Müller, J., 1843, Beiträge zur Kenntniss der natürlichen Familien der Fische: Wiegm. Arch., I, 292.

1844, Bemerkungen über die Cyprinodonten: Mb. Brl. Ak., p. 35.

Müller, J. W. v., 1865, Systematisches Verzeichniss der Wirbelthiere Mexico's: Reisen in den Vereinigten Staaten, Canada und Mexico, III, 625.

Müller, P. L. S., 1774, Des Ritter's Carl von Linné königlich schwedischen Leibarztes, etc., etc. Vollständiges Natursystem, etc., IV.

Müller & Troschel, 1848, Fische in Schomburgk's Reisen in Brit. Guiana, 618.

Nardo, 1827, Prodromus observationum et disquisitionum Adriaticæ Ichthyologiæ: Isis, XX, 474, also Brugn. Giorn., X, 22, and separate.

Nelson, 1876, A partial catalogue of the Fishes of Illinois: Bull. Ill. Lab., I, 33.

Neuer Schauplatz der Natur, 1775, I.

Owen, 1846, Lectures on the Comparative Anat. and Physiol. of the Vertebrated Animals, I, Fishes.

1866, Anatomy of Vertebrates, I.

Perugia, 1891, Appunti sopra alcuni Pesci Sud-Americani conservati nel Museo Civico di Storia Naturale di Genova: Ann. Mus. Civ. Gen., X (2), 605.

Peters, 1844, Ueber einige neue Fische und Amphibien aus Angola und Mozambique: Ber. K. P. Akad. Wiss. Berl., 32.

1855, Uebersicht der in Mossambique beobachteten Fische: Arch. f. Naturg., 234.

1860, Eine neue vom Herrn Jagor im Atlantischen Meere gefangene Art der Gattung Leptocephalus, und über einige andere neue Fische des Zoologischen Museums: Mb. Brl. Ak., 1859, p. 111.

1864, Ueber neue Säugethiere, Amphibien und Fische: Mb. Brl. Ak. Wiss., 381.

1868, Ueber eine neue Untergattung der Flederthiere, so wie über neue Gattungen und Arten von Fischen: Mb. Brl. Ak. Wiss., 145. Naturwissenschaftliche Reise nach Mossambique, Zool., IV, Flussfische.

1876, Uebersicht der von Hrn. Prof. Dr. K. Möbius in Mauritius und bei den Seychellen gesammelten Fische: Mb. Brl. Ak., 435.

Pfeffer, 1893, Ostafrikanische Fische: Jahrb. Hamb. Wiss. Anstalten, X.

Playfair, 1867, The Fishes of Seychelles: P. Z. S. Lond., 846.

Playfair & Günther, 1866, The Fishes of Zanzibar.

Playfair & Letourneux, 1871, Memoirs on the Hydrographical System and the Freshwater Fish of Algeria: Ann. Mag. Nat. Hist., VIII (4), 373.

Poey, 1855, Los Guajacones, Pecesillos de aqua dulce: Mem. Hist. Nat. Cuba, I, 374. Observations on different Points of the Natural History of Cuba, with reference to the Ichthyology of the United States: Ann. N. Y. Lyc., VI, 133. Memorias sobre la Historia Natural de la Isla de Cuba, acompañadas de Sumarios latinos y extractos en Frances, Vol. I.

1861, Conspectus piscium cubensium: Mem. Hist. Nat., II, 357. Poissons de Cuba, espèces nouvelles (1): Mem., II, 115.

1868, Repertorio Fisico-Natural de la Isla de Cuba. Revista de los Peces descritos por Poey: l. c., II., 153. Cubensium genera piscium: l. c., 205. Synopsis piscium cubensium: l. c., 279.

1875–77, Enumeratio piscium cubensium: Ann. Soc. Esp. Hist. Nat., IV (1875), V (1876), VI (1877).

1880, Revisio piscium cubensium: Ann. Soc. Esp., IX, 243.

Putnam, 1863, List of the Fishes sent by the Museum to different Institutions, etc.: Bull. Mus. Comp. Zool.

Rafinesque, 1815, Analyse de la Nature ou Tableau de l'Univers et des Corps organisés.

1820, Ichthyologia Ohiensis.

Richardson, 1836, Fauna Boreali-Americana; or the Zoology of the Northern Parts of British America.

1837, Report on North American Zoology: Rep. Brit. Assoc. Adv. Sci., 6th, for 1836, 121.

1856, On some Fish from Asia Minor and Palestine: P. Z. S. Lond., 371.

1860, The Museum of Natural History, Fishes, 153.

Rochebrune, 1883, Faune de Sénégambie, Poissons.

Rüppell, 1826, Atlas zu der Reise in Nördlichen Afrika, Fische.

Ryder, 1881, Structure and Ovarian Incubation of the Top Minnows (Zygonectes): Forest and Stream, Aug. 18.

1882, Structure and Ovarian Incubation of Gambusia patruelis: Amer. Nat., Feb.

1886, The Development of Anableps [Reprint from Wyman]: P. U. S. Mus., VIII, 128. The Development and Intrafollicular Gestation of Gambusia patruelis: l. c., 143. The Viviparity of Fundulus: l. c., 155.

1887, Development of Fundulus heteroclitus: Jour. R. Micr. Soc., Lond., (2) VI, 941.

Rzaczynski, 1721, Historia naturalis curiosa regni Poloniæ, etc.

1742, Auctuarium historiæ regni Poloniæ, etc.

Sauvage, 1880, Faune Ichthyologique de l' Ogōowe: Nouv. Arch. Mus., III (2), 5.

1882, Note sur les Cyprinodons du groupe du C. calaritanus: G. Révoil Faune et Flore des Pays Çomalis (Afrique Orientale). Notice sur les Poissons du Territoire d' Assinie (Côte d'or): B. Soc. Zool. de France, 313.

1891, Histoire Naturelle des Poissons: Grandid. Hist. Phys. Nat., etc., de Madagascar, 485.

Schlegel, 1850, Fauna Japonica, IV, Pisces.

Schoepff, 1788, Beschreibung einiger Nord-Amerikanische Fische, etc.: Schriften Ges. Naturf. Freunde zu Berlin, VIII, 138.

Schonevelde, 1624, Ichthyologia et Nomenclaturæ animalium marinorum, etc.

Schwenckfeldt, 1603, Therio-Tropheum Silesiæ, in quo Animalium, hoc est Quadrupedium, Reptilium, Avium, Piscium, et Insectorum, vis & usus sex libris perstringuntur.

Scopoli, 1777, Introductio ad historiam naturalem, etc., 450.

Seba, 1761, Locupletissimi rerum naturalium thesauri, etc., III.

Seeley, 1886, The Fresh-water Fishes of Europe, A History of their Genera, Species, Structure, Habits, and Distribution.

Shaw & Nodder, 1801, Vivarium naturæ sive rerum naturalium, variæ et vividæ icones. etc., Vol. XIII.

Shaw, 1804, General Zoology, V.

Smith, J. P. G., 1850, Notes on Callichthys and Anableps: P. Z. S. Lond., 53.

Smith, H., 1892, Notes on Fish from the lower Potomac: B. U. S. F. Comm., X, 63.

1894, Report on Fish from the Albemarle Region of N. C.: B. U. S. F. Comm., XI, 185.

Smith, R., 1880, A List of the Fishes of San Diego, California.

1884, Notes on the Fishes of Todos Santos Bay, Lower Cal.: P. U. S. Mus., VI, 232.

1885, The Fishes of San Diego, Cal.: W. Amer. Scientist, 54.

Steindachner, 1863, Beiträge zur Kenntniss der Cyprinodonten Mejicos: Sb. Ak. Wien, XLVIII, 176.

1865, Zur Fischfauna des Albufera-Sees bei Valencia in Spanien; Sb. Ak. Wien, LII; in Ichthyologischer Bericht über eine nach Spanien und Portugal unternommene Reise, p. 483.

1870, Zur Fischfauna des Senegal, pt. 3: Sb. Ak. Wien, LXI.

1876, Ueber einige seltene oder neue Fischarten von der West Küste der nördlichen Theile Nordamerikas: Sb. Ak. Wien, LXXIV. Ueber einige Meeresfische von den Küsten Brasiliens: l. c. Ueber einige neue Fischarten, insbesondere Characinen und Siluroiden aus dem Amazonenstrome: l. c. Zur Fischfauna von Panama, Acapulco und Mazatlan: l. c.

1878, Ichthyologische Beiträge, VI: Sb. Ak. Wien, LXXVII.

1880, Zur Fisch-Fauna des Cauca und der Flüsse bei Guayaquil: Denk. Ak. Wien, XLII, 55.

1881, Ichthyol. Beiträge, X: Sb. Ak. Wien, LXXXIII.

1892, Ueber einige neue und seltene Fischarten aus der ichthyologische Sammlung des K. K. nat. Hofmuseums: Denk. Ak. Wien, LIX, 357.

1893, Die Fische Liberia's: Notes Leyden Mus., XVI.

1894, Vorläufige Mittheilung über einige neue Fischarten aus den Seen von Mexico: Anz. K. Ak. Wien, 147.

Storer, D. H., 1839, Report on the Fishes of Massachusetts.

1845, Description of a Fish from the Alabama River: P. B. N. H. Soc., 51.

1846, Synopsis of the Fishes of North America: Mem. Amer. Acad., II, 253, also separate.

1853–55, Massachusetts Fishes: Mem. Am. Acad., V, 293.

1867, History of the Fishes of Massachusetts.

Storer, H. R., Observations on the Fishes of Nova Scotia and Labrador, etc.: J. B. N. H. Soc., VI, 247.

Strack, 1826, Naturgeschichte in Bildern mit erläuterndem Text von Professor Dr. Strack, ed. 2, 1834, ed. 3, 1838, Pl. III, Fig. 1.

Troschel, 1845, Note on Cyprinodon orthonotus, Anableps microlepis, Molinesia fasciata and M. surinamensis: Arch. f. Naturg., II, 200.

Turton, 1806, A General System of Nature, etc., I.

Vaillant, 1894, Sur une Collection de Poissons recueillie en Basse-Californie et dans le Golfe par M. Léon Diguet: Bull. Soc. Philom., (8) VI, 69.

Valenciennes, 1839, Rapport sur quelques poissons d'Amérique rapportés par M. Pentland: l' Institut, VII, No. 276, p. 118.

1840, Le Règne Animal, éd. illustrée, Poissons.

1846, Des Pœcilies, des Cyprinodons, des Fundules, des Hydrargyres et des Grundules: Cuv. Val. Hist. Poiss., XVIII, 105.

Valenciennes, 1858, Des Tellia: Compt. rend., XLVI, 715.

Vinciguerra, 1883, Spedizione Italiana nell' Africa Equitoriale: Ann. Mus. Civ. Gen., XVIII, 691.

1884, Materiali per lo Studio della Fauna Tunisina raccolti da G. e L. Doria, I, Pesci: Ann. Mus. Civ. Gen., XX, 393.

Wagner, 1828, Zur Kenntniss der Gattung *Lebias* Cuvier und der verwandten Gattungen, nebst Beschreibung zweyer neuen in Sardinien entdeckten Arten: Isis, XXI, 1050.

Walbaum, 1789, Petri Artedi Renovati, pars I & II, i. e. Bibliotheca et Philosophia Ichthyologia.

1792, Petri Artedi sueci Genera Piscium.

Weyenburgh, 1874, De baring der Pœcilien: Maandblad voor Naturw. —v. h. Natuurgenees en heelk. Genootsch. te Amsterdam, p. 69. Bijdrage tot de Kennis van het visschengeschlacht *Xiphophorus* Heck.: Versl. Ned. Kon. Ak. d. Wetens., VIII.

1875, L' Enfantement des Pœcilies: Periódico Zoológico Argentino, 57. Contribucion al conocimiento del Género *Xiphophorus* Heck., un Género de Pescados vivíparos: Per. Zool., Org. Soc. Zool. Argentina.

1876, Algunos nuevos pescados del Museo Nacional y algunas noticias ictiológicas.

Willughby, 1686, Historia Piscium libri quatuor.

Woolman, 1892, Report upon the Rivers of Central Florida tributary to the Gulf of Mexico, with lists of the Fishes: B. U. S. F. Comm., X, 293.

1894, Report on a collection of Fishes from the Rivers of Central and Northern Mexico: B. U. S. F. Comm., 55.

Wulff, 1765, Ichthyologia, cum Amphibiis regni borussici methodo Linneana disposita.

Wyman, 1854, Account of some Observations on the Development of Anableps Gronovii, a viviparous fish from Surinam: P. B. N. H. Soc., V, 80.

1857, Account of some Observations on the Development of Anableps Gronovii, as compared with that of the Embiotocas of California: P. B. N. H. Soc., VI, 294. Observations on the Development of Anableps Gronovii, (Cuv. & Val.): J. B. N. H. Soc., VI, 1857 (No. IV, 1854), 432.

Yarrow, 1877, Notes on the Nat. Hist. of Fort Macon, N. C., and Vicinity: P. Phil. Ac., 203.

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" olivaceus, **117.**
" sciadicus, **122.**
" " var. lineatus, 122, **123.**

PLATE I.

(m = mandibular, i = intermaxillary, and p = pharyngeal teeth.)

Figs. 1 and 2. *Cyprinodon variegatus* La C.
m and p from specimen $\frac{1}{4}$ inches.
m' from specimen $\frac{3}{4}$ inches.
m'' from specimen $2\frac{1}{8}$ inches.

Fig. 3. *Cyprinodon carpio* Gth.

Fig. 4. *Cyprinodon Floridæ* Goode; Garm.

Fig. 5. *Lebias Sophiæ* Heck.

Fig. 6. *Lebias punctatus* Heck.

Figs. 7 and 8. *Jenynsia lineata* Jen.; Gth.

Fig. 9. *Characodon lateralis* Gth.

Figs. 10 and 12. *Zygonectes Nottii* Ag.

Fig. 11. *Girardinichthys innominatus* Blkr.

Fig. 13. *Zygonectes cingulatus* C. V.; Jor. & G.

Fig. 14. *Zygonectes olivaceus* Stor.; Ag.

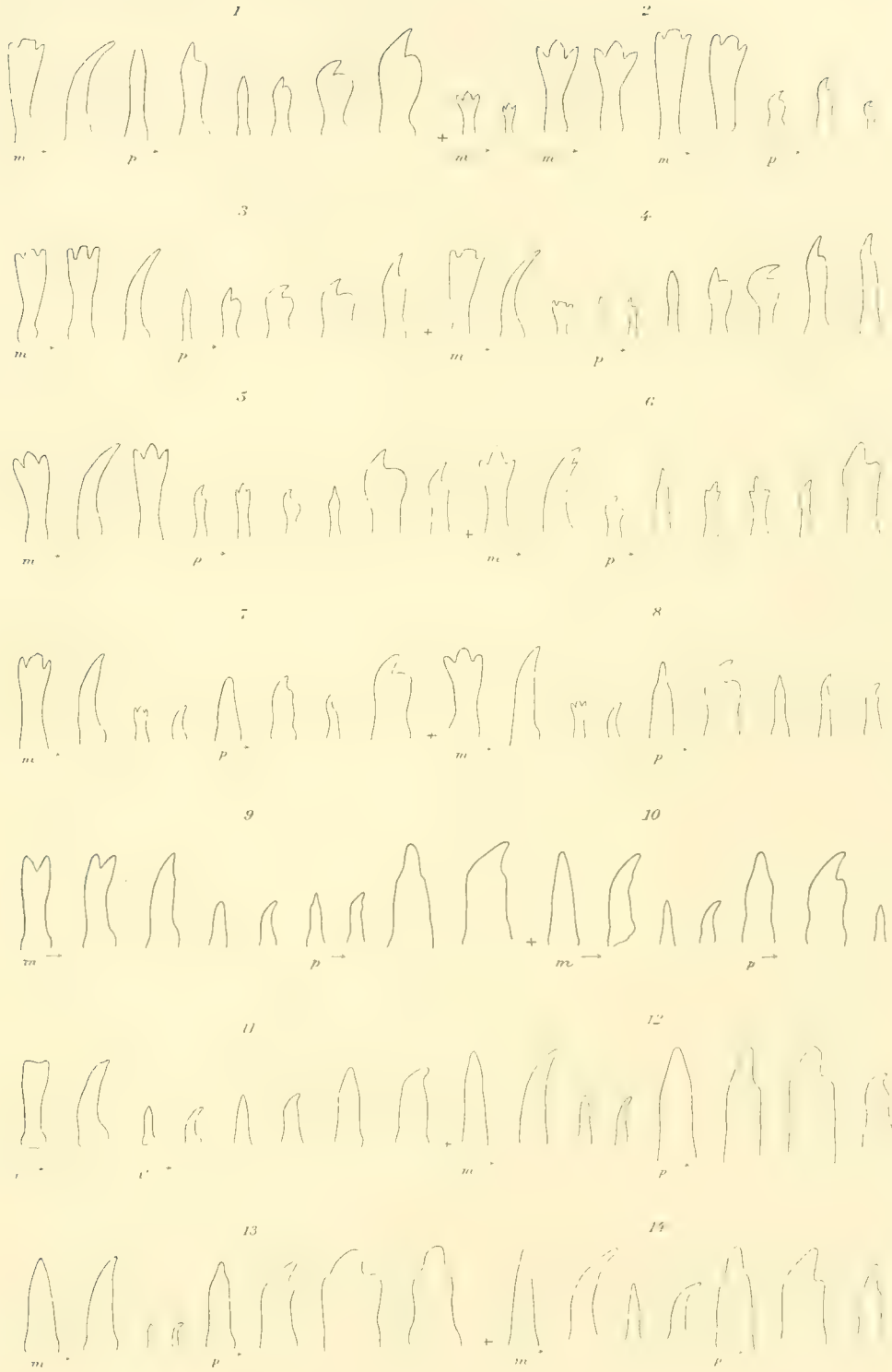

PLATE II.

(m = mandibular, i = intermaxillary, and p = pharyngeal teeth.)

Fig. 1. *Zygonectes sciadicus* Cope; Jor. and C.
Fig. 2. *Fundulus heteroclitus* Linn.; Gill.
Figs. 3 and 4. *Fundulus parvipinnis* Grd.
Figs. 5 and 6. *Fundulus majalis* Walb.; Gth.
Fig. 7. *Fundulus diaphanus* Les.; Bd.
Fig. 8. *Fundulus zebrinus* Jor. & G.
Fig. 9. *Fundulus Rathbuni* Jor.
Fig. 10. *Fundulus Kansæ* Garm.
Fig. 11. *Fundulus catenatus* Stor.; Gth.
Fig. 12. *Fundulus seminolis* Grd.

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PLATE III.

(*m* = mandibular, *i* = intermaxillary, and *p* = pharyngeal teeth.)

Fig. 1. *Fundulus hispanicus* C. V.; Gth.
Fig. 2. *Fundulus capensis* Garm.
Fig. 3. *Adinia multifasciata* Grd.
Fig. 4. *Fundulus Goodei* Jor.; Garm.
Fig. 5. *Lucania parva* Bd.; Jor. & G.
Fig. 6. *Pseudoxiphophorus bimaculatus* Heck.; Blk.
Fig. 7. *Haplochilus panchax* Buch.; Gth.
Fig. 8. *Haplochilus lineatus* C. V.; Day.
Fig. 9. *Orestias Incæ* Garm.
Fig. 10. *Orestias Agassizii* C. V.
Fig. 11. *Orestias Cuvieri* Val.
Fig. 12. *Rivulus brasiliensis* Val.; Garm.
Fig. 13. *Rivulus micropus* St.; Gth.
Fig. 14. *Pterolebias longipinnis* Garm.

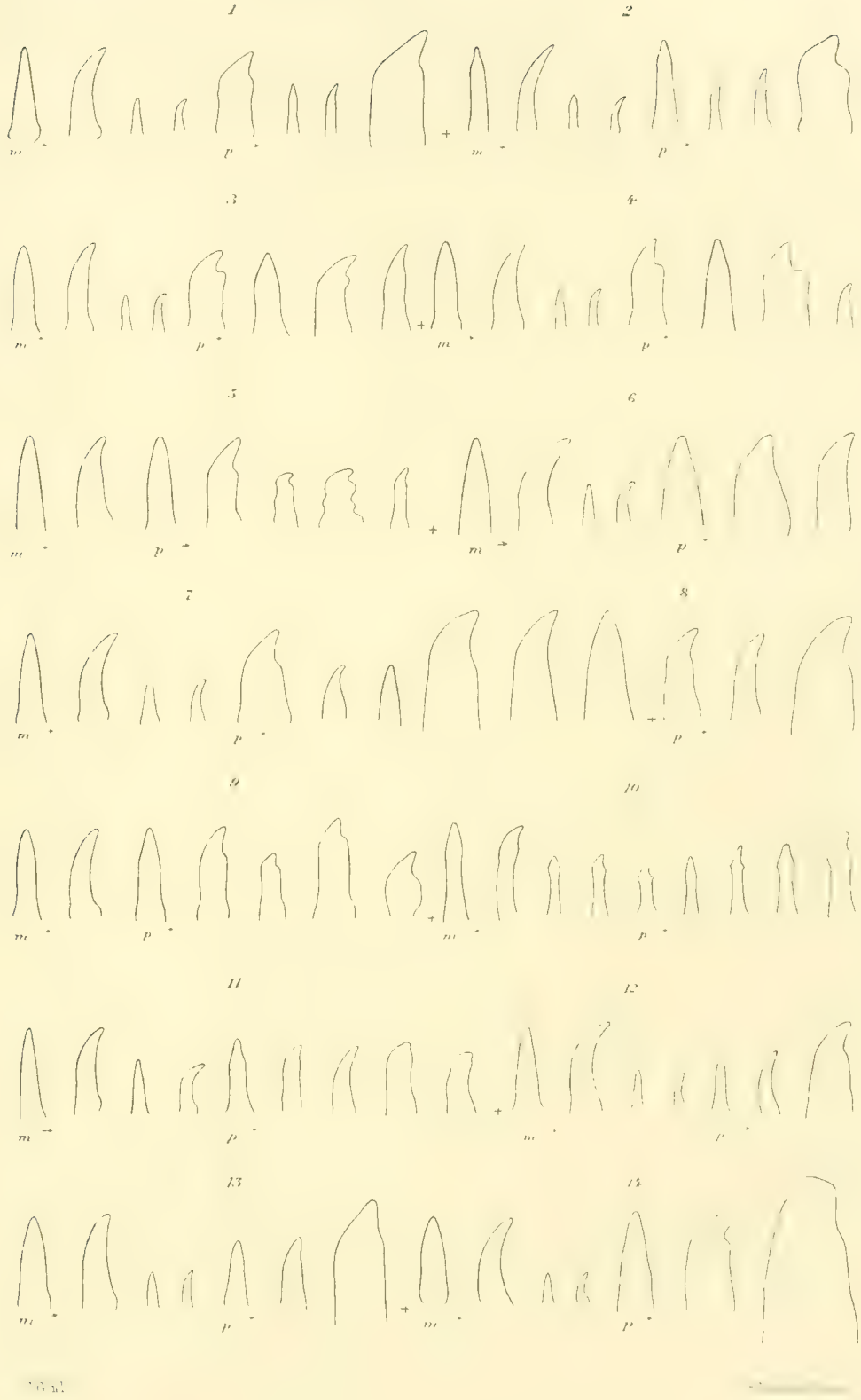
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PLATE IV.

(*m* = mandibular, *i* = intermaxillary, and *p* = pharyngeal teeth.)

Fig. 1. *Anableps anableps* Linné.
Fig. 2. *Anableps microlepis* Müll. & Tr.
Fig. 3. *Gambusia Holbrookii* (Ag.) Grd.; Blkr.
Fig. 4. *Gambusia punctata* Poey.
Fig. 5. *Gambusia episcopi* St.
Fig. 6. *Gambusia gracilis* Heck.; Gth.
Fig. 7. *Heterandria formosa* Ag.
Fig. 8. *Heterandria minor* Garm.
Fig. 9. *Pœcilia amazonica* Garm.
Fig. 10. *Gambusia tridentiger* Garm.
Fig. 11. *Pœcilia vittata* Guich.
Fig. 12. *Pœcilia dominicensis* C. V.
Fig. 13. *Pœcilia sphenops* C. V.
Fig. 14. *Xiphophorus Helleri* Heck.

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PLATE V.

(*m* = mandibular, *i* = intermaxillary, and *p* = pharyngeal teeth.)

Fig. 1. *Mollienisia latipinna* Les.
Fig. 2. *Pœcilia Gillii* Kn. & St.; Gth.
Fig. 3. *Pœcilia cuneata* Garm.
Figs. 4 and 7. *Pœcilia vivipara* Bl. Schn.
Fig. 5. *Pœcilia occidentalis* B. & G.; Garm.
Fig. 6. *Girardinus metallicus* Poey.
Fig. 8. *Glaridodon januarius* Hens.; Garm.
Fig. 9. *Girardinus creolus* Garm.
Fig. 10. *Glaridodon uninotatus* Poey; Garm.
Fig. 11. *Glaridodon latidens* Garm.
Fig. 12. *Cnesterodon scalpridens* Garm.
Fig. 13. *Cnesterodon decemmaculatus* Jen.; Garm.

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PLATE VI.

Anableps anableps Linné.

(Lettering: *a*, auricle; *an*, anus; *b*, belly; *bl*, bladder; *c*, conus arteriosus; *g*, gills; *i*, intestine; *l*, liver; *s*, sinus; *ss*, sinus sacci; *st*, stomach; *v*, ventricle.)

Fig. 1. Embryo, after escape from egg envelope, one and five eighths inches in length, exposing contents of abdominal sac.

Fig. 2. Embryo of one and one fourth inches, showing position inside the membranes, with masses of albumen (*w*.)

Fig. 3. Embryo of one inch, membranes, albumen and outer wall of belly removed, showing intestine, and the blood vessel (*ss*) entering the auricle from the sac.

Fig. 4. Embryo three fourths of an inch in length inside the membranes, showing comparative size of belly and position of masses of albumen.

Fig. 5. Saccular sinus and blood vessels leading to it as indicated by the papillæ on the lower surface of the belly.

Fig. 6. Diagram of hinder portion of right side of belly showing modes of branching and uniting of the blood vessels.

Fig. 7. Diagram of the vessel descending from the sinus below the vertebræ and above the anus to a point below and at the left of the last, whence it sends a branch across and forward on the right side of the sac, also another forward on the left.

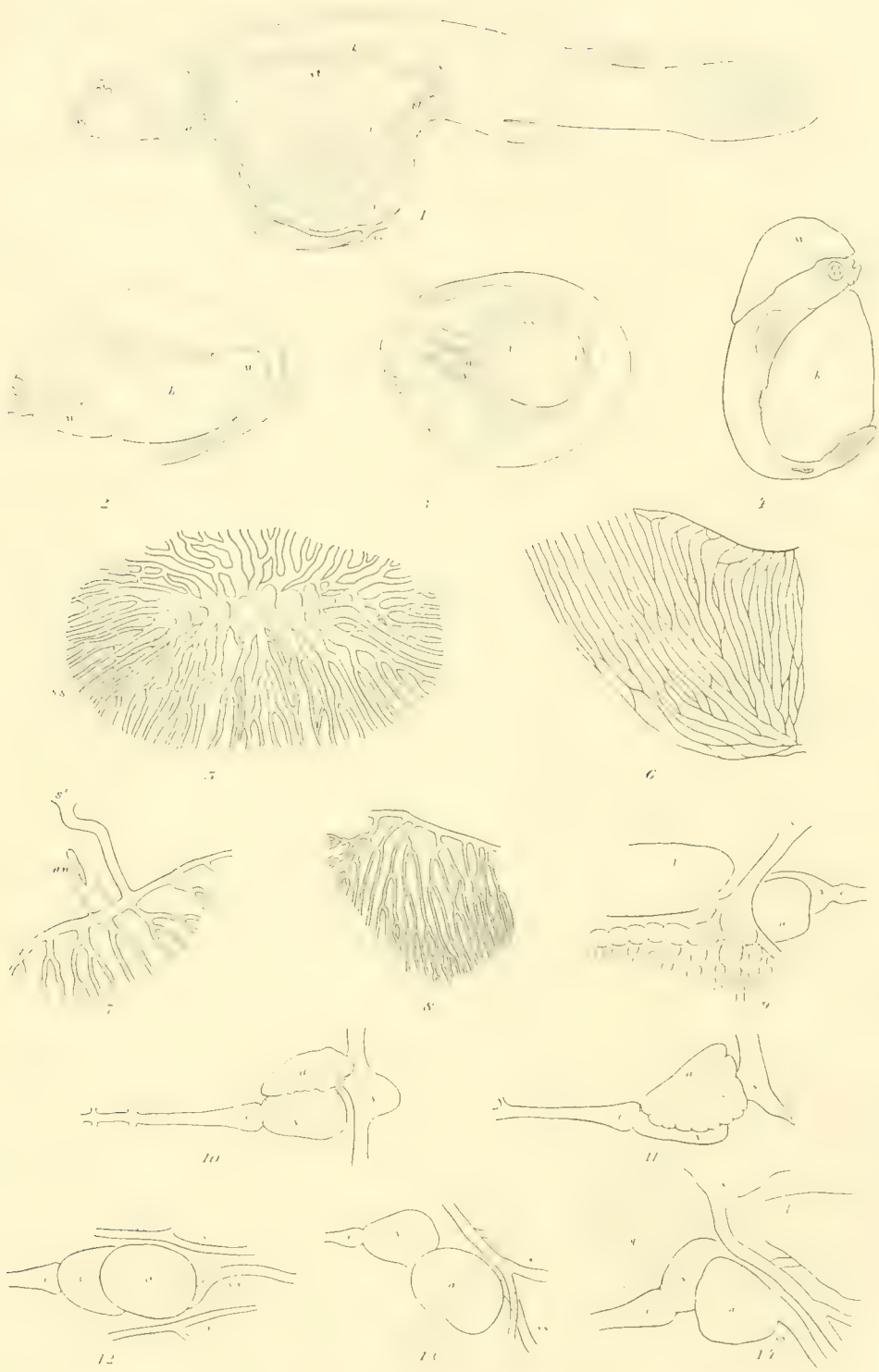
Fig. 8. Outline of vessel and branches passing back and downward on the right side of the sac just back of the heart.

Fig. 9. Right side showing the sinus, at the gill chamber, connected with the liver, extending downward to the branches on the belly, indicated by the rows of papillæ. Dotted lines indicating the main vessel of the belly, the auricle and ventricle.

Figs. 10, 11. Heart of adult of seven and one half inches, lower surface and left side. Natural size three fourths of an inch.

Figs. 12, 13. Heart of an embryo measuring about one inch in total length. Lower view and left side, showing the vessels (*ss* and *s*) that ultimately give way to the auricular sinus.

Fig. 14. Section of left side showing position of heart, liver, gills, precaval sinus, and the sinus sacci (*ss*.)



E.Meyer lith. Boston

PLATE VII.

Anableps anableps Linné.

(Lettering: *a. bl*, air bladder; *i*, intestine; *k*, kidney; *n*, muscle moving anal fin and compressing the seminal receptacle; *o*, ovary; *p*, compressor band on bladder; *s. bl*, seminal receptaculum; *t*, testis; *u*, ureter; *u. bl*, urinary bladder; *x*, muscular valve at junction of ureter and seminal duct; *z*, fold of intestine.)

Fig. 1. Sinistral female, showing the foricular scale opening to the left side.

Fig. 2. Dextral male; with anal turned to the right near its extremity, with a glandular tubercle on the left side, and with tactile extremities to the rays.

Fig. 3. Sinistral male; anal bent to the left, gland on right side.

Fig. 4. Dextral female; foricula opening to right side; heavy dotted line indicating great extent of ovary filled with embryos; light dotted line showing intestine, much crowded forward; broken line tracing the liver, much reduced in size.

Fig. 5. Sinistral female: ovary presenting a forked appearance behind the intestinal fold; intestine and liver occupying much more of the abdominal chamber than in Fig. 4.

Fig. 6. Sinistral male from right side, showing position of bladder, band (*p*) for closing the urinary chamber, muscular valve (*x*) at junction of urinary and spermatic ducts, testis (*t*) and connection with seminal bladder (*s. bl*) in dotted lines, ducts from the kidneys (*k*), and end of intestine (*i*).

Fig. 7. A young male, of three and three fourths inches, before assumption of dextral or sinistral condition, showing the growth of the tube downward from the valve (*x*) along the first ray of the anal.

Fig. 8. Male of four and one half inches, showing transformation of anal farther advanced than in Fig. 7.

Fig. 9. Anal fin of male, of five inches, showing tube in full length of anal. Anal not yet bent to one side, but with gland appearing on left side, which determines the specimen as ultimately dextral.

Fig. 10. Anal fin of sinistral male of five and one fourth inches, with the gland on the right side of the fin, while the tube has taken up a position on the left side of the anterior ray.

Fig. 11. Testis (*t*), end of intestine (*i*), air bladder (*a. bl*), ends of kidneys (*k*), and outer aspect of bladder with muscular valve (*x*) and connected tubes.

Fig. 12. Interior of No. 11, showing internal partitions of bladder, separating into spermatic and urinary chambers, muscular valve (*x*) controlling outflow from both, and tubes of kidney and testis. Dotted line marking extension of spermatic chamber (*s. bl*) upward behind urinary bladder.

Fig. 13. Bladder of male split open on lower aspect, showing ends of ducts from testis, partitions in the interior, and by dotted lines tracing the ureter to the valve (*x*).

Fig. 14. From a sinistral female, left side, with foricula raised to expose openings of ureter and ovary, showing bladder, end of kidney, end of ovary and end of intestine at vent.

Fig. 15. Sinistral male from below, shows testes and ducts, end of intestine, compressor band (*p*), muscles for moving the anal (*n*), muscular valve (*x*) at end of spermatic duct, bladder, and anal fin.

Fig. 16. Intestinal fold, dotted lines tracing the interior.

S G del.

B.Mergel lith Boston

PLATE VIII.

Fig. 1. *Fundulus heteroclitus* Linn.; Gill. Oviduct extended down upon the anal fin.

Fig. 2. *Jenynsia lineata* Jen.; Gth. Male showing the stays from the vertebræ to the base of the anal, the air bladder, testes, ureters, and the tube down upon the anal.

Fig. 3. *Jenynsia lineata.* A young male, with half grown anal tube, resembling the female of Fundulus heteroclitus.

Fig. 4. *Xiphophorus Helleri* Heckel. Male with anal stays exposed.

Fig. 5. *Gambusia Holbrookii* (Ag.) Grd.; Blkr.

Fig. 6. *Gambusia punctata* Poey.

Fig. 7. *Gambusia puncticulata* Poey.

Fig. 8. *Heterandria formosa* Ag.

Fig. 9. *Pseudoxiphophorus bimaculatus* Heck.; Blkr.

Fig. 10. *Pœcilia vittata* Guich.

Fig. 11. *Pœcilia vivipara* Bl. Schn.

Fig. 12. *Mollienisia latipinna* Les.

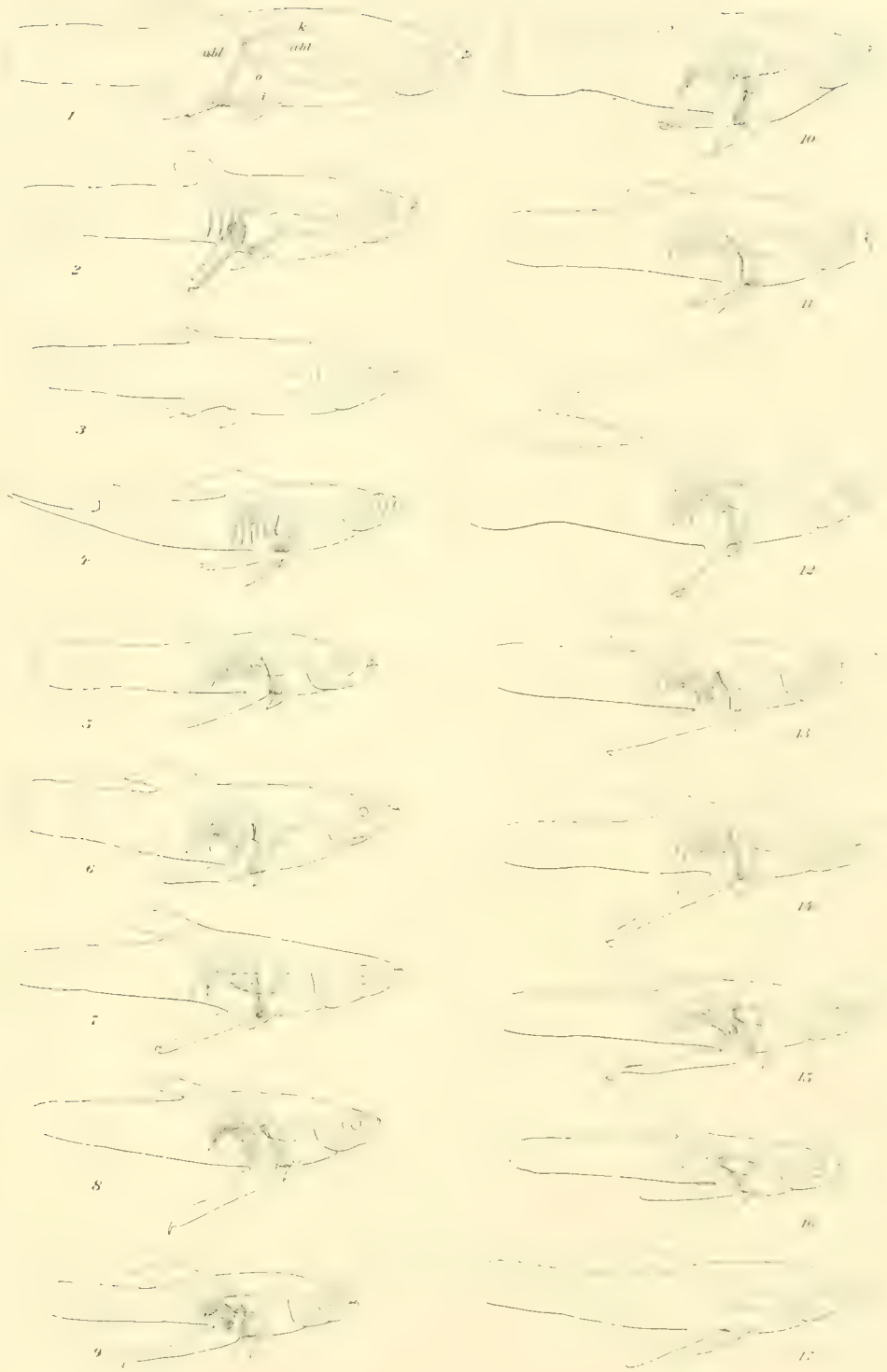
Fig. 13. *Girardinus metallicus* Poey.

Fig. 14. *Glaridodon uninotatus* Poey; Garm.

Fig. 15. *Glaridodon januarius* Hens.; Garm.

Fig. 16. *Cnesterodon decemmaculatus* Jen.; Garm.

Fig. 17. *Cnesterodon scalpridens* Garm.



S.G del.

B.Mazuel lith. Boston

PLATE IX.

Fundulus majalis Walb.; Gthr.

Figs. 1, 3, 5, and 6 indicate the changes of form and markings undergone by males.

Figs. 2, 4, 7, and 8 represent the variations obtaining on females from young to old.

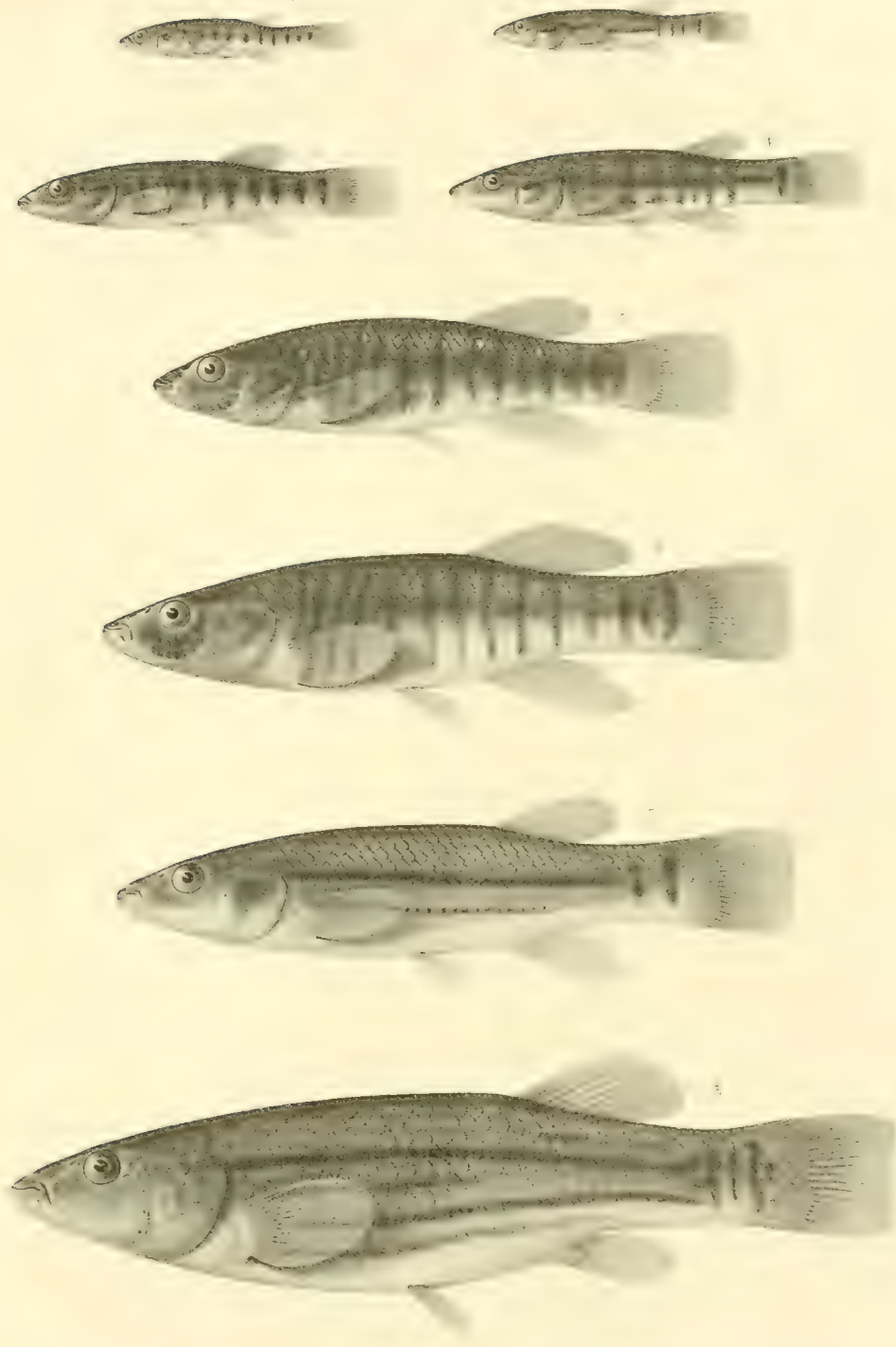


PLATE X.

Figs. 1–9. *Zygonectes Nottii* Ag.

Figs. 10–13. *Zygonectes olivaceus* Stor.; Ag.

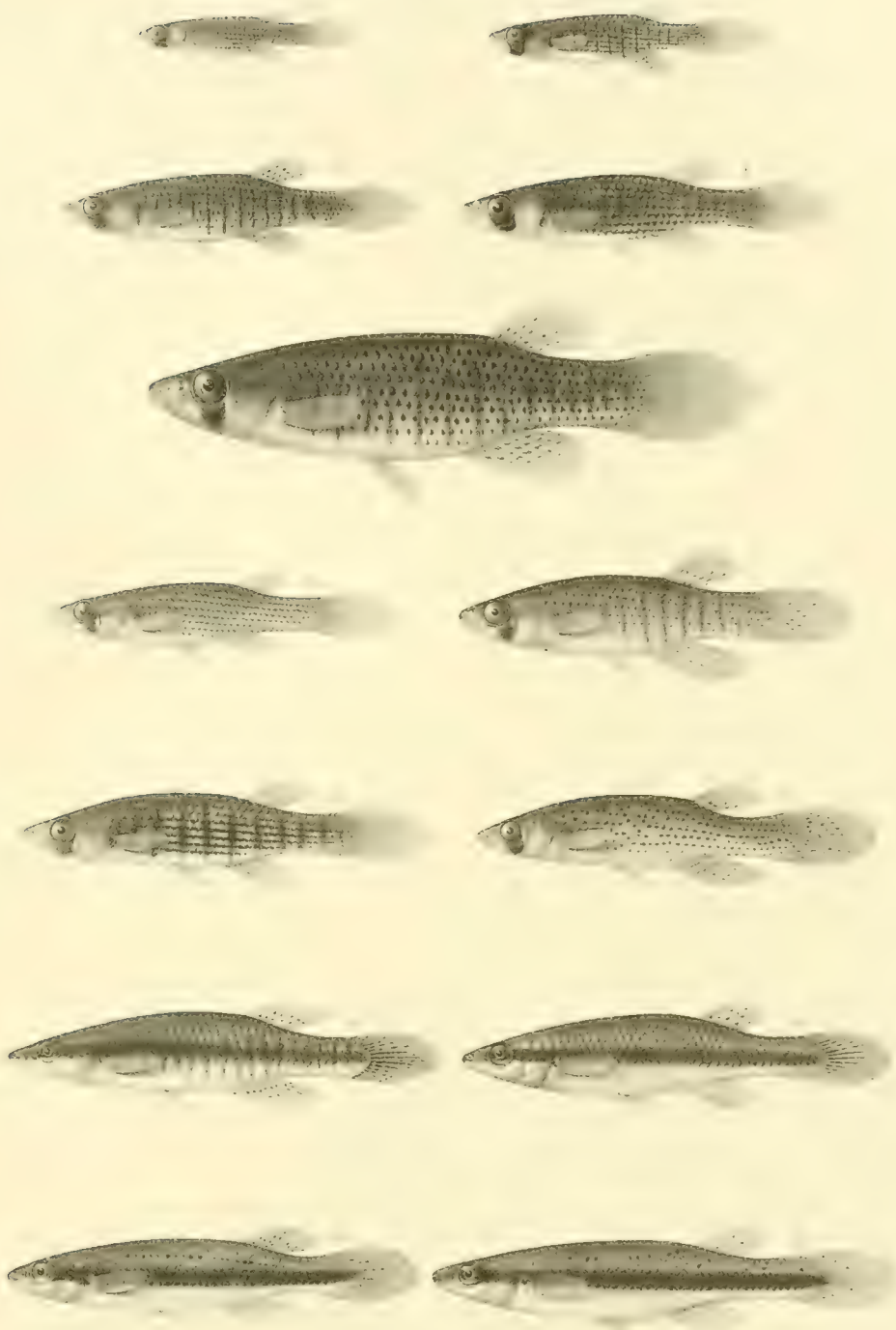


PLATE XI.

Figs. 1–3. *Heterandria formosa* Ag.

Figs. 4–13. *Gambusia Holbrookii* (Ag.) Grd.; Blkr.

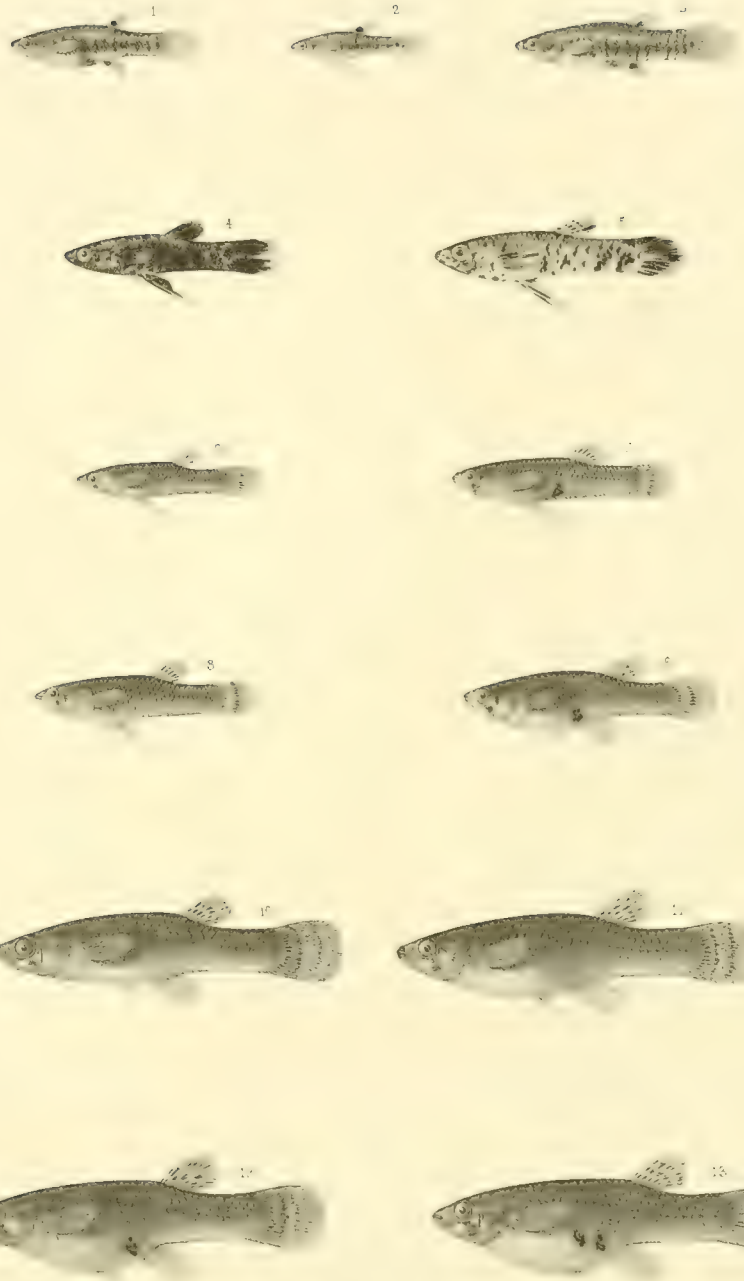


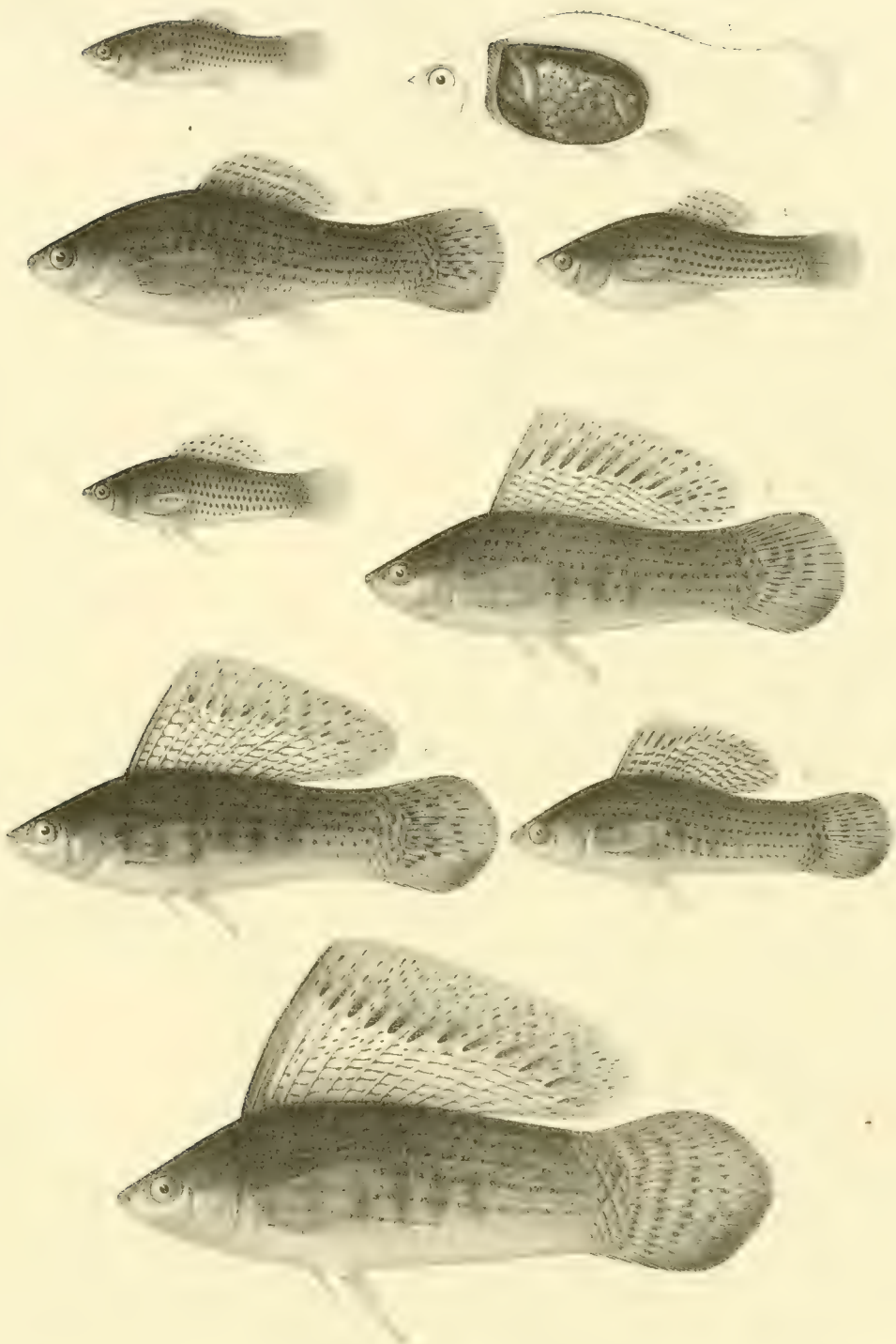
PLATE XII.

Mollienisia latipinna Les.

Figs. 1, 3, and 4 show the markings of the female.

Fig. 2 represents the ovary, with well developed young, and the intestine in a full grown female.

Figs. 5–9 are taken from the male at different ages.



Do not circulate